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EOSDIS Core System Project

EOSDIS Core System (ECS) Requirements Specification

August 1993

Hughes Applied Information Systems, Inc.
Landover, Maryland

Functional and Performance Requirements for the ECS Project

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Preface

This document serves as the revised version of the Government's Functional and Performance Requirements Specification for ECS. It represents the proposed Contractor's baseline for the EOS Project CCB-controlled ECS Requirements Specification. Proposed changes to the current baseline of the document are identified via text mark-ups and change bars (text markups: to textual matter using bolding for additions and strikeouts for deletions, figure markups: via change bars only).

Since proposed requirement moves and deletions involve the use of strikeouts, additional annotation, following each change, is provided to remove the ambiguities. Where there are proposed requirement deletions, a "deleted" annotation follows the requirement. Where the requirements are moved, additional annotation follows the deleted requirement and provides information indicating where it is moved to.

For all changes, consisting of paragraph text wording and requirement moves, deletions, modifications, splits, and derivations, a change rationale is provided in the form of a table with entries for each requirement modified. In addition to this table, change summary information is also provided. This information is enclosed in Appendix F.

Requirement to system release mapping is provided in Appendix G.

This document is a formal contract deliverable with an approval code 1. It requires Government review and approval prior to acceptance and use. Changes to this document also require Government approval prior to acceptance and use. Changes to this document shall be made by document change notice (DCN) or by complete revision.

Once approved, this document shall be under ECS Project Configuration Control. Any questions or proposed changes should be addressed to:

Data Management Office
The ECS Project Office
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Landover, MD 20785

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1. Introduction

The Earth Observing System Data and Information System (EOSDIS) as the National Aeronautics and Space Administration's (NASA) overall Earth Science discipline data system will provide the ground system for the collection and analysis of science data to support scientists in resolving the dynamics of the Earth's components and the processes by which they interact. As a part of the Earth Observing System (EOS) Program, EOSDIS will support: the planning, scheduling, and control of the EOS series of spacecraft; exchanging commands, data, and algorithms with the European Space Agency (ESA), Japan, Canada, the National Oceanic and Atmospheric Administration (NOAA), and any other non-NASA entities involved in the overall EOS mission; the coordination of these activities with other data gathering systems; and the transformation of the observations into physical variables, providing for higher levels of processing and presenting the data to users in forms that facilitate and stimulate interactive scientific research. EOSDIS will support NASA Earth Probe (i.e., non-EOS NASA Earth science flight projects) missions and will add to its data base other selected non-EOS data that are required for use in conjunction with EOS data. EOS, Earth Probe, and other selected non-EOS data and products will be cataloged, archived, and be retrievable in a manner that supports the scientist in developing a better understanding of the way the earth functions. The portion of EOSDIS specified in this document for Phase C/D design and development is called the EOSDIS Core System (ECS).

The ECS is based on the functional and performance capabilities required by the baseline EOSDIS design, i.e., the acquisition, processing, storage, and distribution of the data acquired by the EOS spacecraft; the incorporation of selected non-EOS data sets, specifically data sets produced by sources other than EOS instruments that complement data from EOS instruments in supporting NASA's Earth science research program; and the development of a comprehensive data and information management system.

The ECS ~~shall~~ **will** provide full support as defined in this document for the EOS series spacecraft and its complement of instruments. The ECS ~~shall~~ **will** be expandable to include full support for NASA EOS program instruments flown aboard NASDA and ESA spacecraft as part of the overall international Mission to Planet Earth effort.

In addition to fully supporting EOS series, the ECS will provide information management and data archive and distribution functions for all other NASA Earth science flight missions, NASA instruments flown on non-NASA flight missions, and for all other NASA held Earth science data. This ~~shall~~ **will** include:

a. Existing data held by NASA to be migrated from EOSDIS Version 0, implemented outside the scope of the ECS contract. This data will include data from past and then current NASA Earth science flight missions and other Earth science data held by NASA to support its overall Earth science research program. The ECS contract will include within its scope a level of effort task to support migration of data and metadata into the ECS.

b. Data from NASA Earth science flight missions, collectively known as "Earth Probes," that will deliver data to the ECS after their information management and data archive and distribution functions become operational. This ~~shall~~ **will** include missions on-going as ECS is implemented as well as new missions, such as the Tropical Rainfall Measuring Mission (TRMM), that begin after the ECS is implemented.

c. Data from NASA instruments flown on non-NASA spacecraft whose missions are on-going or begin after the ECS is implemented.

Section 3.3, ECS Data, provides additional information.

This specification establishes the architectural, operational, performance, and functional requirements for the ECS to provide the direction for the Phase C/D design and development.

1.1 Scope

This specification contains the functional and performance requirements of the ECS. The ECS will be an evolutionary development. This specification is the baseline from which the ECS will evolve.

The detailed ECS functional and performance requirements are allocated to specific elements, according to a conceptual architecture, to aid and clarify the presentation of the total ECS requirement. This initial allocation of requirements is not to be considered restrictive of the final system architecture and design. Functional and performance requirements specified at the element level ~~shall~~ **will** be considered system level requirements if the final architecture and design requires multiple elements to satisfy the requirement.

1.2 Document Organization

The document is structured into eight sections plus appendices:

- Section 1, Introduction – Introduces the capabilities of EOSDIS, the purpose, content and structure of the ECS Functional and Performance Requirements Specification.
- Section 2, Applicable and Reference Documents – Lists the set of Government and non-Government documents which form a part of this specification and which are referenced in the Functional and Performance Requirements Specification.
- Section 3, Overview of EOS and EOSDIS – Presents an overview of the EOS mission, EOS Instruments, EOS and non-EOS data, the Science/User Community and the role of EOSDIS within the mission objectives.
- Section 4, EOSDIS Core System Description – Presents an overview of the EOSDIS Core System architecture which provides a basis for the requirements specification. A description of the internal interfaces and major external interfaces is presented along with a high level description of the data flows between the ECS elements and the supporting external facilities.
- Section 5, ECS System-Wide Requirements – Discusses the requirements allocated to the ECS end-to-end system. The system-wide operational, functional, and performance

requirements are specified. In addition, overall system-wide Security, Reliability, Maintainability, and Availability (RMA), and ECS external interface requirements are included in this section.

- Section 6, Flight Operations Segment (FOS) – Presents a description of the FOS and defines the requirements necessary to establish the ground-based control of the EOS spacecraft and instruments. The ECS elements which are part of FOS are the EOS Operations Center (EOC) and the Instrument Control Center (ICC).
- Section 7, Science Data Processing Segment (SDPS) – Presents a description of the SDPS and defines the requirements necessary to establish the ECS science data processing capabilities. The ECS elements which are part of SDPS are the ~~Distributed Active Archive Center (DAAC) and the~~ distributed Information Management System (IMS), ~~The DAAC is comprised of two major sub-elements –~~ the Product Generation System (PGS) and the Data Archive and Distribution System (DADS). **A DAAC, or Distributed Active Archive Center, is a facility where components of the SDPS are delivered.**
- Section 8, Communications and System Management Segment (CSMS) – Presents the concepts, architecture and requirements necessary to define the System Management Center (SMC) and the EOSDIS Science Network (ESN).
- Appendices – Contains appendices to the ECS Functional and Performance Requirements Specification as follows:
- Appendix A: Glossary – Contains the glossary for the ECS Requirements Specification and Statement of Work (SOW).
- Appendix B: Acronyms – Contains the list of acronyms for the ECS Requirements Specification and SOW.
- Appendix C: Data Volumes and Assumptions – Contains tables of data volumes for the spacecraft, instruments, and DAACs.
- Appendix D: EOS Instrument Manifest – Contains a table of instruments residing on the spacecraft.
- Appendix E: Non-EOS Data Requirements Summary – Identifies the types and sources of non-EOS data that are used in the interpretation or validation of data from EOS instruments.

1.3 Traceability

This document contains requirements with unique requirement identifiers to aid in the upward and downward tracing of requirements. An attempt was made to ensure that each unique requirement was written as a "shall" statement and was assigned an identifier. Additional information is contained in "free form textual" descriptions. ~~This specification should be considered in its entirety.~~

~~The text sections potentially contain additional unique and, therefore, traceable requirements.~~ As described in the SOW, the ECS contractor ~~will~~ perform**ed** a requirements analysis and ~~make~~ **made** recommendations for additional (or the deletion **and modification** of) requirements.

1.4 Expandability

This specification describes the performance requirements with which the ECS ~~shall~~ **will** comply during the period of performance of the contract. This specification also describes certain requirements for expandability or future expansion beyond those performance requirements with which the ECS must comply during the period of performance of the contract. These requirements may be added to the ECS during the period of performance of the contract. **The methodology for expandability and future expansion is described in the ECS Systems Engineering Plan (DID 201/SE1), where the ECS System Implementation Plan (DID 301/DV1) details the implementation process.** ~~Therefore, the~~ **The** design, implementation, and maintenance and operations of the ECS must ~~contain the hooks necessary to~~ permit such expansion. Unless explicitly limited to expandability or future expansion, the terms "shall," "shall provide the capability," "shall have the capability," and "shall be capable" ~~shall~~ **will** be interpreted identically and mean that the function, service, capacity, etc. described is a mandatory and current requirement for the baseline ECS with which the contractor must comply during the period of performance of the contract.

1.5 Design Goals

This specification also describes certain design goals that ensure adequate design margins exist for key performance requirements. Adherence to design goals ~~shall~~ **will** be demonstrated by modeling, simulation, and/or analysis as part of the design review process and the as-built configuration audit process. System acceptance ~~shall~~ **will** be based only on specified requirements and not design goals.

2. Applicable and Reference Documents

2.1 Applicable Documents

Applicable Documents (ADs) are those specifications, standards, criteria, etc. used to define the requirements of this specification. In the event of a conflict between an AD and this specification, this specification takes precedence. Should a conflict occur among ADs, the Contractor shall request resolution from the Contracting Officer. ADs shall be considered firm requirements and are binding on the Contractor. The following are applicable documents to this specification.

2.1.1 NASA and GSFC Documents

DOCUMENT NUMBER & DATE	DOCUMENT TITLE
1. ~~541-107, 5/90~~	~~NASA Communications (Nascom) Access Protection Policy and Guidelines~~
2. 420-05-03, 6/15/91	Performance Assurance Requirements for the EOS Data and Information System.
3. NHB 2410.1D, 4/85	Privacy and Security for Automated Information Processing Resources
4. NHB 2410.9, 9/90	Automated Information Security, Volume I
5. NMI 2410.7A, 7/88	Assuring the Security and Integrity of NASA Automated Information Resources
6. ~~Unnumbered, 2/28/89~~	~~Information System Life-Cycle and Documentation Standards, Version 4.3; NASA Office of Safety, Reliability, Maintainability and Quality Assurance - Software Management and Assurance Program (SMAP)~~
NASA-STD-2100-91; 7/29/91	**NASA Software Documentation Standard, Software Engineering Program**
7. NMI 8610.22, 12/89	National Resource Protection Program; Annex A; Consolidated Resource Listing (11/90)

2.1.2 Handbooks, Standards and Military Specifications

DOCUMENT NUMBER & DATE	DOCUMENT TITLE
1. ANSI/X3.159-1989	C Programming Language Standard
2. ANSI/X3.9-1978	FORTRAN Programming Language Standard
3. FIPS PUB 146-1	Government Open System Interconnect Profile (GOSIP)

4. FIPS PUB 151, 9/88	POSIX: Portable Operating System Interface for Computer Environments
5. IEEE 1003.1-1988	Portable Operating System Interface for Computer Environments (POSIX) Standard for System Interface
6. IEEE 1003.2-1988	Portable Operating System Interface for Computer Environments (POSIX) Standard for Shell and Tools
7. IEEE 1003.5-1988	Portable Operating System Interface for Computer Environments (POSIX) Standard for Ada Language Bindings

DOCUMENT NUMBER & DATE	DOCUMENT TITLE
8. IEEE 1003.6-1988	Portable Operating System Interface for Computer Environments (POSIX) Standard for Security Extension
9. IEEE 1003.8-1988	Portable Operating System Interface for Computer Environments (POSIX) Standard for Networking
10. IEEE 1003.9-1988	Portable Operating System Interface for Computer Environments (POSIX) Standard for FORTRAN Language Bindings
11. MIL-HDBK-472, 5/66	Maintainability Prediction
12. MIL-STD-470A, 1/83	Maintainability Program for Systems and Equipment, Task 104
13. MIL-STD-1815-A, 1/83	Department of Defense, Ada Language Reference Manual
14. Unnumbered, 7/90	National Computer Systems Laboratory (NCSL) Bulletin, Guidance to Federal Agencies on the Use of Trusted Systems Technology
15. MIL-HDBK-217~~E~~F	Reliability Prediction of Electronic Equipment
~~16. ISO 7498, 1984~~	~~OSI Basic Reference Model~~
~~17. ISO 7498-4, 11/88~~	~~OSI Management Framework~~
~~18. ISO DIS 10040, 9/90~~	~~OSI Systems Management Overview~~
~~19. ISO DIS 10021, 6/88~~	~~Message Oriented Text Interchange System (MOTIS)~~
~~20. ISO 9040, 11/90~~	~~Virtual Terminal Service—Basic Class~~
~~21. ISO 9041, 11/90~~	~~Virtual Terminal Protocol—Basic Class~~
~~22. ISO DIS 9594, 7/90~~	~~OSI Directory Services~~

2.2 Reference Documents

Reference documents are those documents included for information purposes; they provide insight into the operation, characteristics, and interfaces of the EOSDIS, as well as relevant background information. The Contractor is bound by these documents to the extent specified in this specification or in its applicable documents. The following are reference documents to this specification.

DOCUMENT NUMBER & DATE	DOCUMENT TITLE
1. Announcement of Opportunity No. OSSA-1-88, 88	Earth Observing System (EOS) Background Information Package (BIP), NASA
2. CCSDS 200.0-G-6, 1/87	Report Concerning Space Data System Standards; Telecommand, Summary of Concept and Service, Consultative Committee for Space Data Systems, Washington, DC

DOCUMENT NUMBER & DATE	DOCUMENT TITLE
3. CCSDS 201.0-B-1, 87	Recommendation for Space Data System Standards; Telecommand, Part 1: Channel Service – Architectural Specification, Consultative Committee for Space Data Systems, Washington, DC
4. CCSDS 202.0-B-1, 87	Recommendation for Space Data System Standards; Telecommand, Part 2: Data Routing Service – Architectural Specification, Consultative Committee for Space Data Systems Washington, DC
5. CCSDS 202.1-R-3, 4/90	Recommendation for Space Data System Standards; Telecommand, Part 2.1: Command Operation Procedures, Consultative Committee for Space Data Systems, Washington, DC
6. CCSDS 203.0-B-1, 87	Recommendation for Space Data System Standards; Telecommand, Part 3: Data Management Service – Architectural Definition, Consultative Committee for Space Data Systems, Washington, DC
7. CCSDS 301.0-B-2, 4/90	Time Code Formats, Consultative Committee for Space Data Systems, Washington, DC
8. CCSDS 701.0-B-1, 10/89	Recommendation for Space Data System Standards; Advanced Orbiting Systems, Networks and Data Links: Architectural Specification, Consultative Committee for Space Data Systems
9. 420-03-04, 12/10/91	Earth Observing System (EOS) Program, Level 1 Requirements
10. OMB Circular # A-127, 12/84	Financial Management Systems
11. OMB Circular # A-130, 12/85	Management of Federal Information Resources
12. Unnumbered, 12/90	The Earth Observing System Ground System and Operations Project Level 3 Requirements, Preliminary
13. Unnumbered, 8/90	Interface Definition Document for the Earth Observing System Data and Information System (EOSDIS) Core System, GSFC, Preliminary

14.	Unnumbered, (DRAFT) 9/90	EOS Ground System and Operations Project Standards and Guidelines for Science Data Processing Software
15.	Unnumbered, 8/90	MO&DSD Automated Information System Security Policy, GSFC
16.	Unnumbered, 11/84	General Accounting Office, (GAO) Title 2 – Accounting and Title 3 - Audit
17.	Unnumbered, 87-88	USGS/NMD/EROS Data Center Distributed Ordering, Research, Report and Accounting Network Requirements
18.	Unnumbered, 2/90	Science Data and Information System Requirement, TRMM

DOCUMENT NUMBER & DATE		DOCUMENT TITLE
19.	Unnumbered, 5/90	Science Operation Concepts and Data Processing Scenarios Document, TRMM
20.	Unnumbered, 8/90	Science Data and Information System Architecture Requirement, TRMM
21.	Unnumbered, 9/90	Design Specification Requirements for TRMM Science Data and Information System
22.	DELETED	
23.	560-EDOS-0202.0004, 11/23/92	Earth Observing System (EOS) Data Operations System (EDOS) Functions and Performance Specification
24.	CFR 36, 7/1/87, Part 1234	ADP Records Management, National Archives and Records Administration
25.	NBS Special Publication No. 500-101 (6/83), NBS.NIST	S. B. Geller, Care and Handling of Computer Magnetic Storage Media
26.	Unnumbered, 1990	Managing Electronic Records, NARA Instruction Guide Series
27.	National Archive Technical Information Paper No. 8, 6/90	A National Archives Strategy for the Development and Implementation of Standards for the Creation, Transfer, Access, and Long-Term Storage of Electronic Records of the Federal Government
28.	March 1993	EOS Reference Handbook
29.	**ISO 7498, 1984**	**OSI Basic Reference Model**
30.	**ISO 7498-4, 11/88**	**OSI Management Framework**
31.	**ISO DIS 10040, 9/90**	**OSI Systems Management Overview**
32.	**ISO 9040, 11/90**	**Virtual Terminal Service – Basic Class**
33.	**ISO 9041, 11/90**	**Virtual Terminal Protocol – Basic Class**
34.	**ISO DIS 9594, 7/90**	**OSI Directory Services**

MOVED -- in part from Section 2.1.2

2.3 Science Reference Documents

The following documents are generated by the science community for reference only.

DOCUMENT NUMBER & DATE	DOCUMENT TITLE
1. Unnumbered, 89	Science Advisory Panel for EOS Data and Information, *Initial Scientific Assessment of the EOS Data and Information System (EOSDIS)*, EOS-89-1, 43 pp., NASA Goddard Space Flight Center, Greenbelt, MD
2. Unnumbered, 89	Dutton, J. A., The EOS Data and Information System: concepts for design, *IEEE Transactions on Geoscience and Remote Sensing*, 27, 109-116
3. Unnumbered, 5/90	Dozier, J., *Looking Ahead to EOS: The Earth Observing System*, Computer in Physics
4. Unnumbered, 8/90	National Aeronautics and Space Administration, *Early-EOSDIS Program Plan*, NASA Headquarters, Washington, D.C.
5. Unnumbered, 90	*Planning for the EOS Data and Information System*, J. Dozier and M. Ramapriyan, NATO ASI, (In Press)
6. Unnumbered, 90	Earth Observing System Reference Handbook, NASA (GSFC)

DOCUMENT NUMBER & DATE	DOCUMENT TITLE
7. Unnumbered, undated	*A preliminary EOS Investigator Software System Development Roadmap*, B. Barkstrom and J. Dozier, Draft
8. To be published	*A User Model for EOSDIS*, B. Barkstrom

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3. Overview of EOS and EOSDIS

This section presents background information on the EOS mission and EOSDIS. It is intended to provide a synoptic look at EOSDIS in the context of the EOS program and to address the assumptions and constraints affecting the EOSDIS Core System (ECS) architecture and specifications.

3.1 EOS Mission

EOS is a long-term, interdisciplinary, and multidisciplinary research mission to study global-scale processes that shape and influence the Earth as a system. An objective of the EOS mission is to provide the long-term observations and the supporting information necessary to develop a comprehensive understanding of the way the Earth functions as a natural system. This includes the interactions of the atmosphere, oceans, cryosphere, biosphere, and solid Earth, particularly as they are manifested in the flow of energy through the Earth system, the cycling of water and biogeochemicals, and the recycling of the Earth's crust driven by the energy of the interior of the Earth. The comprehensive global approach to the study of these processes has been termed Earth System Science and has a strong focus on the development of the capability for accurate prediction of the future evolution of the Earth system on time scales of decades to a century.

The EOS mission objectives will be accomplished through the provision of:

a. An observing system to provide the full set of essential, global Earth science data available from low Earth orbit on a long-term, sustained basis and in a manner which maximizes the scientific utility of the data and simplifies its analysis;

b. A comprehensive data and information system to provide the Earth science research community with easy, affordable, and reliable access to the EOS and other appropriate Earth science data;

c. An integrated scientific research program to investigate processes in the Earth system and improve predictive models.

The EOS program is international and interagency in scope. The acquisition of new global science data will be accomplished by the integration and launch of instruments on the spacecraft developed by NASA, the European Space Agency (ESA), and the Japanese National Space Agency (NASDA).

The National Oceanic and Atmospheric Administration (NOAA) will be flying its operational instruments on the first ESA spacecraft as well as on its own free-flyer series and will maintain the data in a database which will be interoperable with the ECS databases. A Memorandum of Understanding between NASA and NOAA defines NOAA's role and its major responsibilities as an active participant in the EOS Program. NOAA data products will be made available to EOSDIS for distribution to requesting investigators. It is also currently envisioned that some instrument data from the EOS spacecraft will be routed directly to NOAA by the Earth Observing System (EOS) Data and Operations System (EDOS).

EOS together with EOSDIS is a complete research and information system capable of acquiring and maintaining long-term, calibrated, time-series data bases of Earth observations and providing access to non-EOS data and research results obtained using EOS data.

The EOS spacecraft, instruments, and the overall program are described in the EOS Reference Handbook.

3.2 EOS Instruments

Please see the EOS Reference Handbook.

3.3 ECS Data

In this specification, "ECS data" is defined as all data, from whatever source, that will be ingested, cataloged, archived, and distributed by the ECS, and therefore for which the ECS ~~shall~~ **will** provide information management and archive and distribution functions as described in Section 7 of this specification.

In this specification, all NASA non-EOS Earth science flight missions, or non-NASA missions on which NASA will fly instruments, are referred to as "Earth Probes." The ground systems external to ECS which provide product generation, principal investigator support, and short term storage are called Earth Probe Data Systems (EPDSs).

The term "non-ECS data" refers to all data held externally to the ECS, by Affiliated Data Centers (ADCs), Other Data Centers (ODCs), or Science Computing Facilities (SCFs). In some cases the ECS will facilitate access to these data.

3.3.1 EOS Spacecraft and Instrument Data and Products

Data and products from the EOS series are referred to in this specification as "EOS data and products," and are described in Appendix C.

3.3.2 ~~3.3.3~~Data from EOS Instruments on International Partner Polar Spacecraft

The ECS ~~shall~~ **will** be designed to be expandable to provide information management and data archive and distribution functions for EOS instruments flown aboard International Partner (IP) Polar Spacecraft.

3.3.3 ~~3.3.4~~NASA Earth Science Data Held by EOSDIS Version 0

As ECS is implemented and EOSDIS Version 0 is phased out, selected Version 0 data will be migrated from Version 0 to the ECS. NASA will select these data on the basis of science priorities and available resources.

Version 0 data will include data from past NASA flight missions, data from some Version 0 time frame NASA Earth Probe and non-NASA missions, and other correlative remotely sensed and in situ data acquired by NASA.

3.3.4 ~~3.3.5~~Pre-ECS Earth Science Data

Pre-ECS Earth Science data (from Version 0 and other existing data systems) will include data, selected by NASA on the basis of science priorities and available resources, from the following Earth Science Missions.

Spacecraft	Instruments
Meteor-3	TOMS
UARS	various
TOPEX	ALT, GPS, TMR
OCM	SeaWiFS
Ozone Explorer	TOMS
ADEOS	TOMS, NSCAT
Landsat (1-6)	MSS, TM, ETM

3.3.5 ~~3.3.6~~Other Mission to Planet Earth Data

Data, products, and metadata from then ongoing and subsequent new Earth science missions, including those listed in the preceding section that are still active and new Earth science missions including the Tropical Rainfall Measuring Mission (TRMM), and Landsat-7 may be selected by NASA for incorporation into the ECS. The ECS will receive these data, products, and metadata from the mission unique data systems.

3.3.6 ~~3.3.7~~Data from Non-NASA Earth Science Flight Missions

The ECS will ingest and provide information management and archive and distribution functions for selected data, products, and metadata from ongoing and subsequent new non-NASA Earth science flight missions in which NASA participates. These will be primarily international missions that involve NASA participation in cooperative ground data handling, and/or that provide data critical to NASA's Earth science research program. These will include data from the following missions:

Spacecraft	Instruments
ERS-1	SAR
JERS-1	SAR
ERS-2	SAR
RADARSAT	SAR

3.3.7 ~~3.3.8~~Correlative Data

The ECS ~~shall~~ **will** ~~be capable of~~ ingest~~ing~~ and ~~providing~~ **provide** information management and archive and distribution functions for selected correlative data required to support NASA's Earth science research program, including non-NASA satellite and in situ data required for EOS product generation or quality assessment and validation.

3.4 Science/User Community

The EOSDIS user community includes three major categories of users, (1) EOS investigators, (2) non-EOS-affiliated science users, and (3) other users. The EOS investigators include the 551 investigators funded or approved by EOS for instrument development and scientific investigations. The EOS investigators support staff also fall into this category. Non-affiliated science users include Earth science researchers at U.S. and foreign government agencies and universities. Examples of other users of EOSDIS include those involved in acquiring data for policy planning, for industrial and commercial applications (e.g., timber or petroleum industry) or for monitoring and analyzing EOSDIS systems usage, capabilities, and performance. ECS user support staff will use the system to assist users in acquiring data sets of interest.

EOS data policy will help transcend the traditional boundaries of access to mission data for these groups. EOSDIS will make EOS data and information available to the community without a waiting period in which the data are considered proprietary. Investigators using data are expected to contribute products back to EOSDIS, so that the data and information base maintained by EOSDIS will grow in size and science value over time.

3.4.1 EOS Investigators

There are three types of EOS-funded science investigators:

> Instrument Investigators [a single Principal Investigator (PI) plus Co-Investigators (Co-Is)];
>
> Research Facility Instrument Teams [a single Team Leader (TL) plus Team Members (TMs)]; and
>
> Interdisciplinary Investigators [a single PI and Co-Is].

Instrument Investigations are performed by a group of scientists interested in investigations which include the design, development, test, calibration, operation, algorithm development, and data analysis for Earth observing instruments. These scientists, under the leadership of the PI, will plan and conduct research, reduce, analyze and interpret data, and publish their results. The PI will ensure that the experiment definition, instrument design and development, planning and support of mission operations, and data validation, quality control, analysis, and publication are successfully carried out. The Co-Is will assist the PI in meeting his responsibilities and will participate in the group's operation as defined in a Science Management Plan.

A Research Facility Instrument Team consists of selected scientists who are interested in investigations which make use of one of the Research Facility Instruments being developed by the EOS Project, and who can contribute substantially to guiding its design, development, test, calibration, operation, data reduction, or algorithm development. The Research Facility Instrument Team Members (TMs) will function in a manner similar to Co-Is on an instrument investigation. Each team will be organized under the direction of a Team Leader (TL). The TL will have primary responsibility for the conduct of the Team's Investigation as well as direction of Team activities.

An Interdisciplinary Investigation is conducted by a group of scientists interested in the analysis and interpretations of data from EOS instruments as well as data from other sources. The purpose of this type of participation is to exploit the synergistic nature of the EOS experiments to assure that the multidisciplinary scientific tasks of EOS are adequately addressed, to help guide the development of EOSDIS and to provide a strong theory and data analysis perspective to mission planning. In addition to analyzing data, these investigations may include the development of theoretical models whose capabilities and results would be made available to the EOS investigator community. The interdisciplinary investigators, under the leadership of the PI, will plan and conduct the research, analyze and interpret EOS and non-EOS data, and publish their results.

The range of disciplines contained in this portion of the science/user community covers the atmosphere, biosphere, cryosphere, hydrosphere, and solid Earth. Within the user community there are two major orientations, the instrument-oriented user and the discipline-oriented user. The instrument-oriented user is usually a remote sensing scientist concerned with how best to use the data from a given instrument to learn more about the environment. This user will be particularly interested in how best to calibrate ~~"his"~~ **the** instrument and validate its data products. ~~He~~ **The user** will also be interested in developing new sensing techniques. The discipline-oriented user will usually be a PI or Co-I associated with an interdisciplinary science team. ~~His~~ **Their** interest is more likely to involve use of data from multiple instruments to tackle a science problem.

Within the discipline-oriented users, there is a further important distinction between investigators interested in global data sets and investigators oriented towards regional data. The two geographic interests are important for such data operations as subsetting and data examination. A global investigator is likely to want overviews and latitudinal averages as part of his searches for meaningful data. A regional investigator is likely to want to look at small portions of the Earth with many different kinds of data. ~~He~~ **The investigator** will need subsets of many of the standard data products. Design of the EOSDIS should also take into consideration that several of the discipline-oriented investigations involve global modelling. This activity requires a large number of diverse inputs and large volumes of data are generated by running the model.

EOS investigators and their staff will have different levels of familiarity with computer investigations of data and data retrieval technology. They will also have different preferences for their method of interacting with the EOSDIS in searching for and ordering data. Although a continuum of experience and knowledge is likely to be present, instrument-oriented investigators are likely to be focused on their instrument data and similar kinds of data in EOSDIS, whereas discipline-oriented investigators are likely to be less familiar with the full range of data that might apply to their work. Furthermore, instrument-oriented investigators are likely to be data producers; discipline-oriented investigators are likely to be data users. These distinctions have important ramifications for the organization of the data and metadata, and for the work done by the EOSDIS Information Management System (IMS).

3.4.2 Non-EOS Affiliated Science Users

The user community of the EOSDIS is broad (see "A User Model for EOSDIS," B. Barkstrom). It extends past the boundary of mission-selected research scientists (the TLs, TMs, PIs, and Co-Is) associated with a particular instrument or research investigation. EOS data and information will be used by the broader operational and research communities, including such groups as U.S. and international operational agencies and the international Earth science research community at academic and government institutions. Fittingly for a science program studying global processes, the EOSDIS user base will be global in nature, spanning not only U.S. and IP investigator teams, but the general international science community as well.

Researchers at academic and governmental institutions who are not affiliated with the EOS Program will be able to access the EOSDIS catalogs and order EOS and related data products. In particular, the EOS data system will provide access to data for research programs of other U.S. Government agencies (e.g., U.S. Geological Survey, NOAA, and the National Forest Service).

Non-EOS affiliated science users will include on their application for resources an abstract of the work to be done, their university or corporate affiliations, funding agencies, and fields of scientific research. These users will also indicate whether the EOS data and EOSDIS services will support such activities as non-profit scientific research, industrial research, operational forecasting, regulatory or law enforcement, or producing engineering requirements for future observation systems.

During the early years of this effort, these users are likely to be drawn from the pool of existing customers of Earth science data, including the Climate, Land, and Ocean Data Centers, as well as users of the Landsat and SAR data bases. As EOSDIS develops, this portion of the user community should expand.

In contrast with the EOS investigators, many of the non-EOS affiliated science users will have a much greater need for a user-friendly data search capability and extensive help features. These users will likely become the dominant community when EOS data are being produced on an operational basis, after validation.

3.4.3 Other Users

Other users constitute a population with more diverse characteristics than the two categories listed previously. These users can be further subdivided into the following groups:

- Policy makers and implementers
- EOSDIS and EOS managers
- EOSDIS development and operations personnel
- External system developers and tool developers
- Small data set users

- Commercial/applications users
- Educational users

Policy makers and implementers include such groups as Congressional staff, and employees or consultants for state and local planning organizations. These users are expected to want to use EOS data for examining the current situations under their jurisdictions.

EOSDIS and EOS managers will interact with EOSDIS for such purposes as obtaining accounting information, analyzing system use and user profiles, and measuring other statistical information that will aid in managing and planning EOS and EOSDIS. These users will likely often be required to generate system wide reports related to system usage and data holding for NASA management and budget authorities.

The EOSDIS development and operations personnel will access EOSDIS to test and tune the components of the system and to carry out daily operations and maintenance. In addition, the user support staff will access the IMS component to assist science users in searching metadata and ordering data.

External system developers include consultants and other individuals developing systems outside the EOS data use activity who wish to gain insights from the EOSDIS design. Such users are likely to want to try all elements of the system, but will not have a serious long-term use for the data, since their interests lie in the development of systems involving other kinds of data.

Tool developers and users are individuals who wish to explore ideas for data manipulation and visualization. These individuals are not likely to use large amounts of data. Rather, they will work with a small amount of data repeatedly. These individuals are usually quite competent at computer programming.

Small data users are individuals who want only a small amount of data for illustrative purposes in a scientific research paper. The amount of data they desire is likely to fit in a current floppy disk file. They would prefer to have the data in ASCII format so that they can read it with a microcomputer.

Users of EOS data for commercial and engineering applications are a potentially large and unknown community. These include traditional users of remote sensing data such as the timber and petroleum industry who use large quantities of data, but on an ad hoc basis. The NASA AO for the EOS states: "Data dissemination for commercial purposes will be consistent with applicable laws of the country which is the lead provider of the instrument or of the research that produces the data." Additional users will include diverse groups such as civil engineers who use remotely sensed data for site selection and modelling, commercial fisheries industry, news media, and others. It is hard to predict the nature and numbers of these users, however they will be concerned with the ability to use EOS data in vendor supplied systems (primarily geographical information systems and image processing systems).

Educational users include various college and, potentially, high school or other users who may wish to use EOS data and algorithms for teaching purposes. These individuals will likely exhibit characteristics similar to either tool developers or small data set users depending upon academic level or study discipline.

3.5 Science Computing Facilities

Science Computing Facilities (SCFs), located at science investigator facilities, will be used to develop and maintain algorithms, produce data sets, validate data, and analyze and synthesize EOS and other data to expand knowledge about the Earth System and its components. The ECS will provide toolkits for use by scientists at the SCFs. SCFs are outside the scope of this contract.

3.6 International Partners

EOSDIS also supports interfaces to the IPs who, as major participants in the EOS program, provide spacecraft, instrument payloads, satellite communications relay, and data acquisition, processing, archiving, and distribution capabilities. Considerable coordination will be required to make EOSDIS work on an international scale. Memoranda of Understanding will be signed between NASA Headquarters and the European Space Agency (ESA), a representative agency in Japan, and the Canadian Space Agency (CSA) which detail each agency's participation.

ESA will provide two spacecraft with the first ESA spacecraft carrying NOAA operational instruments. The Space Technology Agency (STA) of Japan will provide one spacecraft with a potential for adding subsequent spacecraft. All agencies will exchange data and will support planning and scheduling, commanding, and operations of instruments on their respective spacecraft. Instruments from several countries will be carried by U.S. spacecraft, requiring commanding support as well as data processing and exchange services. U.S. participants will require data from international payloads on any of the spacecraft and the international participants will require access to U.S. payload data for their processing and/or investigations. EOSDIS will also provide for the exchange of data between the U.S. and the many international databases.

3.7 Operations Concept

The operational EOSDIS can be divided into two major areas of functional responsibility – Mission Operations and Data Operations.

Mission operations encompass the coordination of operation of EOS instruments, the operation of the spacecraft and its support systems, and the scheduling and operational use of institutional services such as the Space Network (SN), the EOS Communications (Ecom) and the Flight Dynamics Facility (FDF). Mission operations also address the planning, scheduling, commanding, and operation of the flight instruments. Each instrument's operations are constrained to work within the framework of overall spacecraft mission operations and each must schedule and/or share spacecraft services such as power and communications. Mission operations are scheduled to meet the objectives of the EOS long term science plan and thus are focused on the accomplishment of science data acquisition. This function requires determining and monitoring the health and safety of the spacecraft and payloads and protecting the spacecraft and payloads from harm caused by the malfunction or misoperation of any payload or system.

Data operations include the receipt of instrument science data via the SN, EDOS, and Ecom; the routine processing and reprocessing of the instrument data to standard data products; quality assuring, accounting, cataloging, and archiving of these data products; the management of data, metadata, and information; and the distribution of these data products to the user community. Distribution will be varied: electronic methods may serve for some data sets and data queries; however, express or regular mail shipment of data on tapes or optical disks may be more cost effective for larger data sets. Also included in data operations are access to instrument and spacecraft engineering data, and access to non-EOS data archives. Additionally, the receipt, archiving, and distribution of non-standard EOS data products from the EOS investigators, and of data from the TRMM, Landsat-7 other Earth Probes, and other data sources, are part of data operations.

3.8 EOSDIS Role

A major key to the success of the EOS mission lies in the successful implementation of the EOSDIS. This distributed information system will provide access to data from the EOS instruments, Earth Probe instruments, related data, and to the scientific results of the research using these data. A fully realized EOSDIS will provide the data management infrastructure for space-based Earth science research in the 1990s and beyond. The EOSDIS role includes:

a. Receive, process, store, and manage all data from the mission and research results;

b. Receive, store, and manage data and products from the TRMM mission, Landsat-7 mission, and other NASA Earth Probe missions as they are identified;

c. Provide for the distribution of data to investigators, the exchange among the investigators of research results, and the information system capabilities, including software, required to carry out the research;

d. Provide access for the Earth science community to all EOS, TRMM, Landsat-7, and other Earth Probe data and the data products resulting from research using these data;

e. Provide the planning and scheduling for, and the command and control of, space elements of the mission.

EOSDIS will provide the capabilities for spacecraft command and control of the NASA spacecraft with EOS payloads; for instrument command and control for all NASA instruments on any spacecraft; for having the data processed and active, permanent archiving of data from EOS instruments, Earth Probe instruments, and selected other data; and for exchanging commands, data, and algorithms with non-NASA entities involved in the overall EOS mission.

EOSDIS will also provide information on the location and content of Earth science data sets, provisions for ordering and acquiring new data sets from the spacecraft, acquisition and processing of standard data sets for use by the user community, obtaining, retaining, and distributing detailed research results (special data sets) which have made use of EOS data, and for supporting selected EOS investigations. The EOSDIS must be designed to provide easy access to EOS, TRMM, Landsat-7, Earth Probe, and other archived data from the beginning to at least five years beyond the end of the EOS observing mission (i.e., for at least 20 years after the launch of the first EOS spacecraft).

EOSDIS is conceived as a complete research information system that incorporates traditional mission data system facilities, but includes additional capabilities such as well-calibrated, well-documented long-term data products and direct, on-line electronic data access for EOS researchers.

Key functional objectives for the overall EOSDIS system include:

a. Unified and simplified means for accessing and obtaining Earth science data;

b. Prompt access to all levels of data and documentation concerning the processing algorithms and validation of the data, and to data sets and documentation that result from research and analyses conducted using the data provided by EOS and Earth Probes;

c. Enabling a distributed community of Earth scientists to interact with data sources and mission operations from their home facilities;

d. Responsiveness to user needs;

e. Capability for evolution, growth, and adaptation to new sources of data and new data system technologies.

ECS will provide the basic functionality of EOSDIS as described in Section 4.

4. EOSDIS Core System (ECS) Description

This section describes the EOSDIS Core System (ECS) in terms of the system architecture, external interfaces, ECS functionality, and a high-level view of operations.

4.1 ECS Architecture

Because of its size and complexity, the ECS is conceived as a hierarchy of segments, elements, subsystems, and components. Three ECS segments are defined to support three major operational areas: flight operations, science data processing, and communications/system management. The segments are further divided into ECS functional elements to provide the support required by the operational segments. Subsystems and components are used in the common sense to refer to the hardware and software systems and equipment supporting the ECS elements.

The three major ECS segments and their supporting elements are described below and may be found in Figure 4-1:

a. A Flight Operations Segment (FOS) which manages and controls the EOS spacecraft and instruments. The FOS elements include:

   1) EOS Operations Center (EOC) – GSFC element responsible for mission planning and scheduling and the control and monitoring of mission operations of the EOS spacecraft and instruments.

   2) Instrument Control Centers (ICCs) – the elements responsible for scheduling, commanding, and operating the science instruments and for monitoring of instrument performance. Several ICCs constitute an Instrument Control Facility (ICF).

   3) Instrument Support Terminals (ISTs) – investigator-site ECS software to connect a Principal Investigator (PI) or Team Leader (TL) to an ICC in support of remote instrument control and monitoring. (Investigator facilities are shown in Figure **4-1** outside the FOS, but connected to it via the ESN.)

b. A Science Data Processing Segment (SDPS) which provides a set of processing and distribution elements for science data and a data information system for the entire EOSDIS. The SDPS ~~elements include~~ **consists of**:

   ~~1) Distributed Active Archive Centers (DAACs) – ECS and institutional facilities including Product Generation System (PGS) and Data Archive and Distribution System (DADS) facilities which process data from the EOS instruments to standard, Level 1–4 data products, provide short- and long-term storage for EOS, Earth Probe, and other related data, software, and results, and distribute the data to EOSDIS users.~~

   1) Product Generation System (PGS) - an element which processes data from the EOS instruments to Level 1-4 data products.

2) **Data Archive and Distribution System (DADS) - an element which provides short and long term storage for EOS, and other Earth Observing Missions, and other related data, software, and results, and distributes the data to EOSDIS users.**

~~2)~~ **3)** Information Management System (IMS) – a distributed data and information management **element and user services suite** ~~service~~ for the ECS including a catalog system in support of user data selection and ordering. The IMS will be implemented in a distributed configuration, with the distribution of IMS functions between the DAACs and an IMS coordinating element to be optimized to meet the requirements of the ECS specification. The IMS must function as a single integrated service from the point of view of the user, and must present the same comprehensive view of the ECS from any IMS access node. The distribution of IMS functions must not compromise the integrity of the IMS as a whole. The inter-agency Global Change Master Directory (GCMD) for all Earth science data sets, based upon the Master Directory developed by the National Space Science Data Center (NSSDC) at GSFC, will be incorporated into the ECS as the basis for the directory function within the IMS.

~~3) Field Support Terminals (FSTs) – portable terminals which can be employed at field investigation sites to provide access to one or more DAACs. The FST will provide access to the IMS, allowing a field investigation team to search the EOSDIS directories for data of immediate interest, and to request data which could be delivered to the field location for use by the field team. (FSTs are shown in Figure 4-1 outside the SDPS, but connected to it via the ESN.)~~ **<MOVED>**

c. A Communications and System Management Segment (CSMS) which provides overall ECS management and operations of the ground system resources, provides facilities and communications/networking services for an extensive science data communications network, and manages the interfaces to NASA's Space Network (SN) and Deep Space Network (DSN), the Wallops tracking station, the EOS Communications (Ecom), the Program Support Communications Network (PSCN), and other communications networks. **SN, DSN, and Wallops tracking station are accessed by CSMS via the Ecom interfaces.** The CSMS elements include:

1) System Management Center (SMC) – a system management service for EOSDIS ground system resources.

2) EOSDIS Science Network (ESN) – a dedicated internal ECS communications network and services providing, **in combination with other institutional and public networks,** for the interconnection of the widely distributed EOSDIS facilities, IPs, and EOS investigators at their ISTs or SCFs as required to support ECS operations; and a separate network interface from the ECS to gateways provided by the NASA Science Internet (NSI) to external science research networks in support of other science communities' access to the ECS.

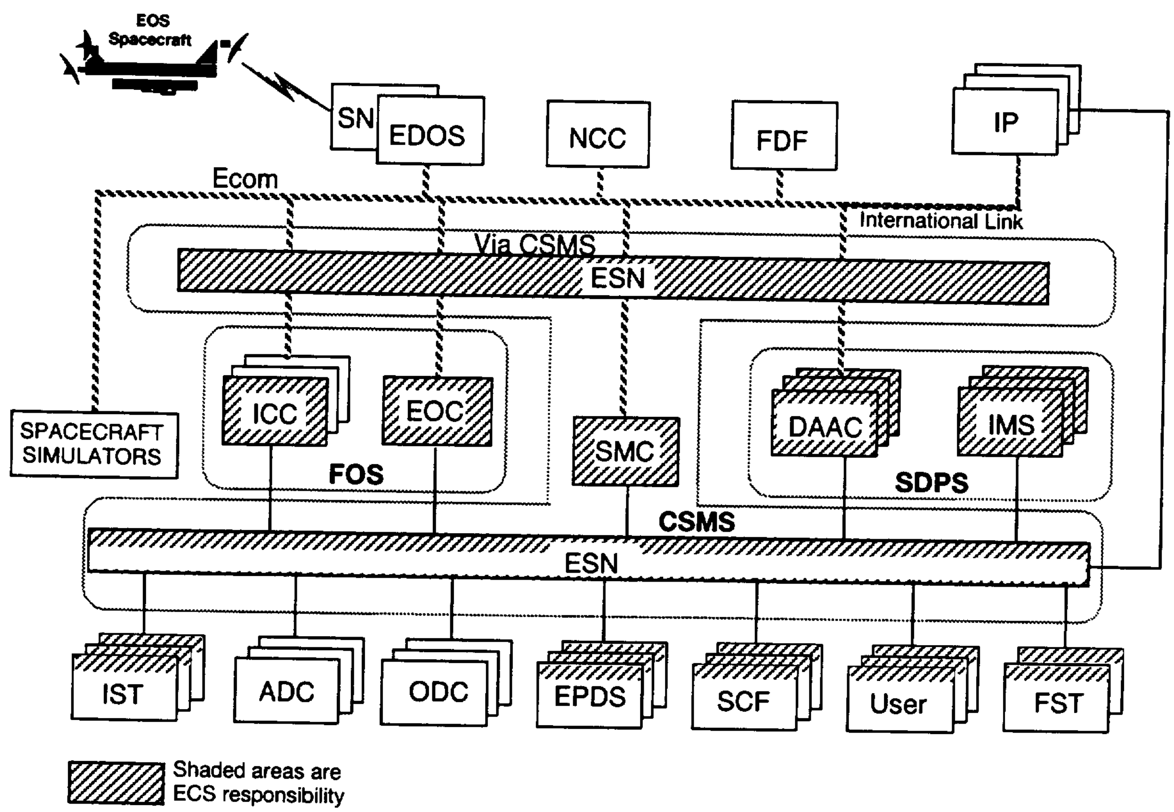

Figure 4-1. ECS Architecture

Field Support Terminals (FSTs) - portable terminals which can be employed at field investigation sites to provide access to one or more DAACs. The FST will provide access to the IMS, allowing a field investigation team to search the EOSDIS directories for data of immediate interest, and to request data which could be delivered to the field location for use by the field team. (FSTs are shown in Figure 4-1 outside the SDPS, but connected to it via the ESN, and other Government supplied WAN circuits, institutional networks, and/or dedicated links.)

Figure 4-1, ECS Architecture, depicts the ECS segments and elements, the external supporting systems, their ~~physical~~ interconnections, and interfaces. There are other EOSDIS systems that are themselves outside the scope of the ECS contract and which will be separately provided by the Government. These are shown as unshaded boxes in Figure 4-1. Shaded areas in the IST, EPDS, SCF, User, and FST boxes in Figure 4-1 represent ECS software toolkits that will reside on compatible external hardware. The **WAN and dedicated** communications circuits for ~~ESN~~ **ECS site interconnection and the ESN interface with ISTs, EPDS, ADCs, and selected SCFs** will be provided by the Government.

There is one EOSDIS element that is to be provided by the spacecraft contractors, the spacecraft simulators.

4.2 Major Functions

The major ECS system-level functions relate directly to the responsibilities assigned to each of the ECS segments:

a. Flight Operations Segment
  - Mission control
  - Mission planning and scheduling
  - Instrument commanding
  - Spacecraft commanding
  - Mission operations
  - Spacecraft ~~and instrument~~ health & safety
  - Instrument health & safety
  - Spacecraft sustaining engineering analysis

b. Science Data Processing Segment
  - Data processing
  - Data archive
  - Data distribution
  - Data information management
  - User support for data information
  - User support for data requests
  - User support for data acquisition and processing requests
  - User support for algorithm migration
  - Data and results ingest

c. Communications and System Management Segment
  - Distribution of EOS data and information to EOSDIS nodes
  - Distribution of data among DAACs
  - Interface with external networks

- Network/communications management and services
- System configuration management
- System/site/elements processing assignment
- System performance, fault, and security management
- Accounting and billing
- Communication of data sets, models, and software
- Coordination of DAAC product generation and inter-DAAC data transfer schedule
- Final resolution of production schedule conflicts

These functions pertaining to the ECS segments and elements are described in detail in Sections 6.0, 7.0, and 8.0, respectively.

4.3 ECS External Interfaces

ECS will utilize, where possible, the functionality and facilities of institutions and organizations external to ECS. This external support includes such facilities and/or resources as the EOS Project, the SN, the Earth Observing System (EOS) Data and Operations System (EDOS), the Flight Dynamics Facility (FDF), EOS Communications (Ecom) capabilities, and other NASA and NOAA institutional data management and storage facilities. The following paragraphs discuss the supporting elements associated with the EOS project, institutional facilities, networks, data centers, and the user community. Interfaces with these supporting elements are illustrated in the Conceptual ECS System Context diagram, Figure 4-2.

4.3.1 EOS Project

Although the ECS is contained within the EOS project, certain elements of the EOS project are considered to function as external interfaces to the ECS elements. These elements include the EOS spacecraft, **EDOS, Ecom, Version 0** the instrument payloads, and the EOS Investigator Working Groups.

The EOS Project is developing a series of spacecraft. They will consist of a spacecraft core with power, thermal control, communications and tracking, attitude control, and orbit maintenance subsystems, data processing and storage, interfaces for forward and return link communications, and the capability to support multiple research and prototype operational payloads. The ECS FOS will interface with the EOS instruments through EDOS to support commanding, monitoring, fault management, and control requirements.

EDOS, data handling, and data distribution capability being developed by NASA, will provide data handling services for ECS. EDOS will also maintain a back-up archive of Level 0 data, and provide copies of Level 0 data from the back-up archive to the ECS upon request. The services to be provided by EDOS are:

- **Data Delivery – Transfer of forward and return link data via the SN between designated sources and destinations and handling of data returned via the SN from the EOS spacecraft up through Level 0 data processing.**
- **Back-up Data Archival – Permanent storage of Level 0 data.**

- **EDOS Operations Management – Provision of data, network, and system management services for all of EDOS. It will provide a consistent interface to ECS for data accounting, fault isolation, and configuration management. It will coordinate the electronic exchange of information among the EDOS services.**

Version 0, the initial version of EOSDIS will provide interoperability with ECS during the early development phases and will provide data for full migration to ECS during later versions.

The EOS Project has a supporting ground element for the series of EOS spacecraft, the spacecraft simulators. This element is not part of the ECS, but supports development and operations of EOS spacecraft.

4.3.2 Institutional Facilities

~~EDOS, a mission management, data handling, and data distribution capability being developed by NASA, will provide data handling services for ECS. EDOS will also maintain a back-up archive of Level 0 data, and provide copies of Level 0 data from the back-up archive to the ECS upon request. The services to be provided by EDOS are:~~

- ~~Data Delivery – Transfer of forward and return link data via the SN between designated sources and destinations and handling of data returned via the SN from the EOS spacecraft up through Level 0 data processing.~~
- ~~Back-up Data Archival – Permanent storage of Level 0 data.~~
- ~~EDOS Operations Management – Provision of data, network, and system management services for all of EDOS. It will provide a consistent interface to the customer for data accounting, fault isolation, and configuration management. It will coordinate the electronic exchange of information among the EDOS services.~~

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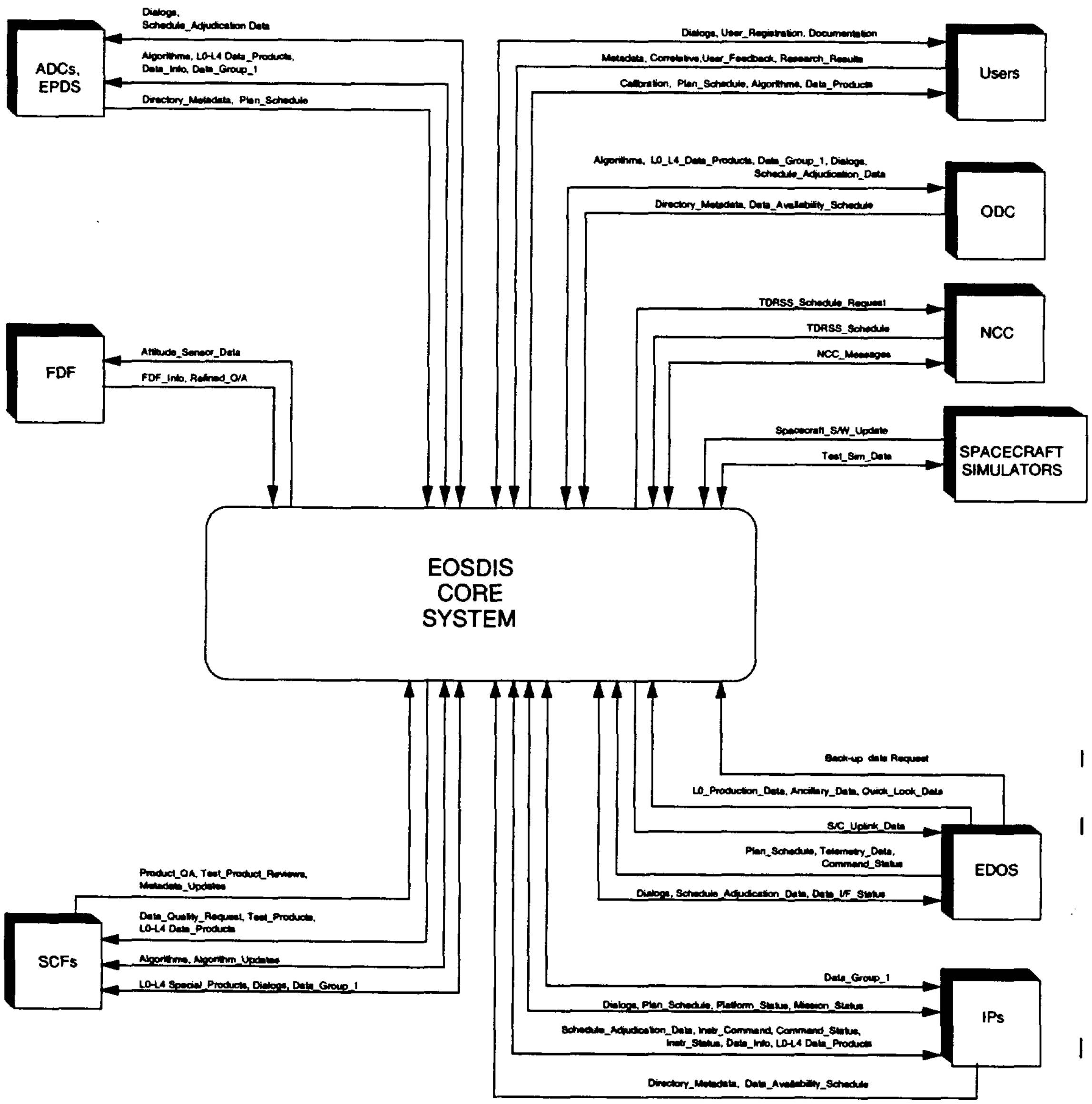
Earth Probe data, products, and metadata will be delivered to ECS via the Earth Probe Data Systems.

In addition to EDOS, the FDF at GSFC will play a role in supporting ECS. The FDF provides orbit, attitude, and navigation computational services in support of NASA flight projects. Pre-launch services include mission design analysis, trajectory analysis, sensor analysis, and operations planning. Operational support services include orbit and attitude determination, anomaly resolution, maneuver planning and support, sensor calibration, post-delta velocity analysis, and generation of planning and scheduling data products. In providing operational support to the EOS spacecraft and the instruments, the FDF will interact directly with the EOC to provide ephemeris predictions and post-maneuver verification of spacecraft parameters. It will also support the DAACs to quality check the down-linked orbit/attitude and other ephemeris data, provide repaired or refined orbit and attitude values as needed, and provide algorithms for ephemeris data transformations, calibrations, and transformations.



Dialogs:
- Interactive_Session_Dialog
- DAR_Status_Dialog
- Products_Request_Dialog
- User_Dialog
- Info_Dialog/Information_Dialog
- Service_Coord_Dialog
- Data_Dialog

Plan_Schedule:
- IP_Plan_Schedule
- Instr_Plan_Schedule
- Data_Availability_Schedule
- Processing_Schedule
- Acq_Plan_Schedule

Data_Group 1:
- Metadata
- Ancillary_data
- Calibration_data
- Correlative_data
- documents

Figure 4-2. Conceptual ECS System Context

4.3.3 Networks

Networking and communications support for EOSDIS will be provided by the SN, Ecom, the PSCN, and the NSI. Other institutional and commercial networks may be used also as links to the ESN for general science community users.

The SN will be the primary data transport system for relaying data between EOS spacecraft and the ground, and will provide communication resource scheduling support to ECS. The SN consists of the Network Control Center (NCC) at GSFC and the Tracking and Data Relay Satellite System (TDRSS), which includes the Tracking and Data Relay Satellites (TDRS), the White Sands Ground Terminal (WSGT), and the Second TDRS Ground Terminal (STGT) also located at White Sands. The two TDRS ground stations will be capable of supporting at least four TDRSs. The WSGT already exists; the STGT is in the implementation phase. These ground terminals will support TDRS services for multiple spacecraft, including EOS. The ground terminals will have enough redundancy to meet the data-timeliness requirements. Their wide-band communication ports will allow transfer of large data volumes to EDOS in real-time. Collectively, the SN elements will provide the communications path between the spacecraft Communications and Tracking (C&T) system and EDOS.

The DSN, the Ground Network (GN), and the Wallops tracking station will be used as a backup to the SN, **and are accessed by ECS via Ecom and EDOS**.

The TDRSS provides forward link and return link services. EOS spacecraft will use an average contact period of 30 minutes per orbit for high rate data, and data will be return linked to one of the TDRS ground stations and forwarded directly to EDOS for further routing. Forward links available for commanding include a 1 Kbps **S-Band** Multiple Access (~~MA~~ **SMA**) link, a ~~1~~ **10** Kbps S-band Single Access (SSA) link, **a 2 Kbps emergency operations link via S-Band DSN,** ~~a 100 Kbps Ku-band Single Access (KSA) link,~~ and a 125 bps SSA link (contingency). There are also multiple return link services. These include: a 300 Mbps KSA link (combination of I and Q channels at 150 Mbps each) for science data; a 16 Kbps MA link for real-time housekeeping data; 16 Kbps and 512 Kbps Single Access (SA) links for real-time housekeeping data; and a 1 Kbps SA link for contingency purposes.

The NCC is the operations control center for all SN activities. The NCC provides operational management of all elements of the SN and is responsible for all scheduling activities for TDRS, the ground terminals, and interfaces to Ecom. The NCC implements operations execution schedules, coordinates the scheduling for international relay, and performs link monitoring and fault isolation functions.

Ecom includes the circuits, switching, and terminal facilities arranged in a global system to provide operational telecommunications support for all **EOS-related** NASA projects. Ecom will provide the data transport path from the EDOS elements to the DAACs, ICCs, and EOC. It supports a variety of bandwidths and utilizes state-of-the-art communications methods, including fiber optics and domestic communications satellites. Ecom also interfaces with other NASA, government, and commercial networks.

The PSCN provides programmatic and administrative data communication services between NASA Headquarters, NASA centers, and other users. The PSCN Control Center, located at

Marshall Space Flight Center (MSFC), has overall responsibility for the scheduling, software development, maintenance, and monitoring of the PSCN. PSCN circuits will be used for the ESN backbone.

The NSI is a multi-discipline and multi-project network operated by the NASA Science Internet Project Office at NASA's Ames Research Center which provides data access and interchange among a wide variety of NASA science disciplines. The NSI incorporates the NSN and the Space Physics Analysis Network (SPAN). **SPAN will be supportable upon upgrade to DECnet Phase V.** It will provide direct user access to services provided by EOSDIS, as well as gateways to other networks that will be part of the EOSDIS communications interface.

A number of commercial networks are expected to provide user access to EOSDIS. This connectivity may either be direct or via one of the government networks. International networks also will provide connectivity to EOSDIS, either directly or via another network. One of the major networks is the International Communications Network (ICN), which will provide connectivity between the IPs and the NASA networks. Non-NASA government facilities are expected to access EOSDIS through NSF and either ARPANET or MILNET and their successors.

4.3.4 Data Centers

In addition to the NASA data centers a number of institutional facilities will play a role in ECS either by hosting **SDPS elements as** a DAAC or serving as an Affiliated Data Center (ADC). ADCs will share data and results with DAACs. Other Data Centers (ODCs) will provide EOSDIS with access to existing Earth science databases and correlative data. ECS will support all NASA Earth Probe Data Centers (EPDSs) beginning in 1997, including all non-EOS Earth science flight projects. ECS will archive and distribute these data. The primary data centers supporting EOSDIS include:

<u>DAACs</u>:

a. Goddard Space Flight Center (GSFC), Greenbelt, Maryland
b. Earth Resources Observation System (EROS) Data Center (EDC), Sioux Falls, South Dakota
c. Jet Propulsion Laboratory (JPL), Pasadena, California
d. Langley Research Center (LaRC), Hampton, Virginia
e. University of Colorado, National Snow and Ice Data Center (NSIDC), Boulder, Colorado
f. University of Alaska, Alaska Synthetic Aperture Radar (SAR) Facility (ASF), Fairbanks, Alaska*
g. Marshall Space Fight Center, Huntsville, Alabama
h. Oak Ridge National Laboratory, Oak Ridge, Tennessee*

*** These DAACs have no ECS-provided product generation capability.**

<u>ADCs</u>:

a. National Oceanic and Atmospheric Administration (NOAA). NOAA facilities may include one or more of the following:
   - National Climatic Data Center (NCDC)
   - Satellite Data Services Division (NCDC/SDSD)

- National Geophysical Data Center (NGDC)
- National Oceanographic Data Center (NODC)
- National Environmental Satellite, Data, and Information Service (NESDIS) Satellite Processing Center (Suitland)
- University of Wisconsin, Madison, Wisconsin

b. Consortium for International Earth Science Information Network (CIESIN), Michigan (designated as a Social-Economic Data and Applications Center)

EPDSs:

a. Tropical Rainfall Measuring Mission (TRMM) Data Center
b. Data centers for selected other missions following TRMM.
c. Landsat data handling facility

4.4 System Data Flow

This section provides an overview of the flow of data in the ECS necessary to satisfy the EOS mission objectives. A detailed discussion of the types of data processed by ECS, both that ~~flowing~~ **flow** to external elements and ~~that~~ **are** used by the ECS elements, is presented later with each of the element level discussions.

The operations and command data flowing between the FOS and EDOS supports the operation of the EOS series of spacecraft and instruments. The FDF exchanges orbit and attitude (O/A) information with the FOS.

The majority of the data that flows from external elements to ECS is the raw science data which comes to the SDPS from EDOS. EDOS will process the data to Level 0 and deliver the data and ancillary data to the ~~SDPS~~ DAACs. In addition, the ECS will receive data from the TRMM mission data system, other EPDSs, and some ADCs and ODCs.

The data products generated in the SDPS are distributed to the participating data centers, the science user community, and requesting non-EOS data centers. The SDPS also generates data products, in a short time frame, which are sent to the FOS for evaluation. Requests for data acquisitions, data processing, data products, data and product information, and analysis reports and other EOS literature are sent to the SDPS from these same users and data centers. Algorithms and processing and calibration software are also provided to the SDPS from the participating investigator facilities. Users will provide research results, such as new derived data sets, back to the SDPS.

The CSMS interfaces with all of the ECS segments to perform global system management, communications/network management, monitoring, and control functions. Operations and management data related to end-to-end fault management, configuration management, performance management, and security management are shared between all segments.

4.5 Operational View

The ECS system provides the ground facilities and procedures to support and operate the EOS mission. This includes planning and scheduling science instruments usage, generating command sequences to be sent to the spacecraft instruments, processing production data (Level 0) from EDOS to higher levels, and coordinating scheduling of product generation at the DAACs and data transfers between DAACs that support product generation. Data received include scientific observations and measurements performed on board the spacecraft, instrument engineering and other ancillary data used for instrument control and monitoring, and non-EOS data required to perform scientific investigations. Data from foreign instruments flying on U.S. spacecraft will be made available to the responsible foreign agencies. **For a more detailed discussion regarding ECS operations, refer to the ECS Operations Concept Document (DID 604/OP1).**

ECS data processing functions are supported by a management system which provides functions such as configuration control, billing and accounting, performance measurement and system security. Although each of the ECS elements provides management for all its functions, a System Management Center (SMC) provides overall system management guidelines, **through an LSM,** to the system elements. The ESN , **in combination with other institutional networks, Government supplied dedicated links, the Internet, and other public networks,** ~~provides~~ **support** data communications to and from ECS elements and users.

This section provides a high level overview of these ECS operations, beginning with the receipt of the Data Acquisition Request (DAR) from a user up to the archiving of the data product and its subsequent delivery to the user. DARs can be submitted for special one-time data acquisitions or as standing orders for routine processing and distribution of data.

Data acquisition begins with the submission by an authorized user of a DAR to the IMS, after identifying a need for data not yet in the archive. The DAR contains information which identifies the data needs of the user which, if known, may include instrument(s) to be used for acquiring the data, observation time(s), geographic area(s), or a specific campaign. The IMS provides tools for the user to enter the DAR and performs a high-level reasonability check on the user's input. Once the DAR is complete at the IMS level, the IMS sends the DAR to the ~~EOC~~ **appropriate ICC** for further analysis and scheduling.

~~After the EOC has performed a preliminary analysis to determine which instruments and related ICCs will support the requested observations, each relevant ICC will receive a copy of the DAR.~~

The ICC performs several functions, some of them in conjunction with the ISTs, which may be located remotely or adjacent to the ICC. Among these functions are the monitoring of on-board instrument health and safety, interactive planning and scheduling with the EOC, and instrument command generation.

After receiving the DAR from the ~~EOC~~ **IMS** and analyzing it, the ICC translates the DAR into a common scheduling request notation which specifies the instrument operations, spacecraft power, data volume, and other spacecraft resources required. The scheduling notation retains the flexibility of the original request and may specify observation times in general terms (e.g., twice a month, three times within the next week, etc.).

After resolving any conflicts with other operations and DARs for its instrument, the ICC integrates the DAR, **an instrument resource profile, or if a baseline profile exists, an instrument resource deviation list.** ~~into a 28-day Short Term Instrument Plan (STIP)~~. Once a week, the ICC sends **this resource information** ~~its current STIP~~ to the EOC.

The EOC integrates all ~~the STIPs~~ **resource requirements** received from the ICCs, incorporates any planned spacecraft operations, **and** resolves high level spacecraft and inter-instrument conflicts **in order to determine the best available TDRSS contact times.** ~~and produces a 28-day Short Term Operations Plan (STOP) for the entire series of spacecraft and instruments. The EOC uses the STOP to determine SN TDRSS resources and submit a request for these resources to the NCC.~~ **The EOC submits these times in a request to the NCC where negotiations may take place before the final contacts are settled upon. Approximately one week before the target week (TW), the EOC sends the finalized TDRSS times to the ICCs in a preliminary resource schedule.**

One week before the active week, the ICC uses the current **preliminary resource schedule** ~~STOP~~ and any late changes to generate an **instrument activity list or instrument deviation list.** ~~Instrument Activity Specification (IAS).~~ Although ~~the IAS~~ **these activity lists are** is in the common flexible scheduling notation, it has sufficient details in it to be used for command generation at the ICC.

The EOC receives and integrates the ~~IASs~~ **instrument activities** from the ICCs, combines them with spacecraft operations and generates a ~~Conflict-Free Schedule (CFS)~~ **detailed activity schedule** which specifies exact times for spacecraft and instrument operations to occur.

If conflicts occur during this process, the EOC first attempts to resolve them automatically using the flexibility of the scheduling notation and established priorities. Next, the EOC will communicate with the ICCs to resolve conflicts. The project scientist or designated deputy will make final decisions on science requests which can not be resolved by the ICCs. The Mission Operations Manager (MOM) will make decisions regarding the health and safety of the spacecraft.

Instrument commands necessary to carry out the ~~CFS~~ **detailed activity schedule** are requested by the EOC from the respective ICCs. Upon receipt of the requested instrument commands from the ICCs, the EOC checks and integrates them into the spacecraft command sequences. The commands are then transmitted to the spacecraft for subsequent execution via the EDOS White Sands facilities and the SN TDRSS.

After observation data are acquired aboard the spacecraft, they are combined with engineering and other ancillary data and transmitted to the ground via TDRS. They are received at the White Sands ground terminals, and EDOS performs production processing to produce a Level 0 product at the Fairmont, West Virginia facility.

Quick-look science data are handled by the ground system in an expedited manner. The data (or a subset thereof) may go directly from EDOS to an ICC as raw data packets or, the data may be quick-look processed in both the EDOS and the PGS and then sent on to an ICC.

EDOS transmits production data from each of the instruments and spacecraft sensors to a specifically designated DAAC. ~~The DAAC holds the received data temporarily until the PGS is ready to process them.~~ Any external data required to generate the scientific product will be ~~requested via the IMS, which in turn will arrange to have them~~ sent to the requesting DAAC. This may include data or products from one or more other DAACs. When all the necessary science, external, and ancillary data have been assembled, they are staged to the PGS for processing to a level specified in the requestor's DAR. Although data may be processed up to Level 4, all data will be processed to at least Level 1.

In addition to the science data, the PGS generates supporting data such as instrument observation logs for generation of instrument mode histories and status summaries to be used for browse and metadata. Additional data are produced for quality assurance (QA). After QA is complete, an evaluation of data quality is entered into the corresponding metadata. If no QA has been performed on the data, a corresponding flag in the metadata will indicate that fact to the user. All data will be processed at least once, but the PGS will be capable of reprocessing data as new and improved processing algorithms are developed.

The processed data, together with their corresponding metadata and other supporting data, are stored in the DADS. Supporting data may, for instance, include the version of the algorithm used to process the data, if there is more than one. The DADS will also store the algorithms themselves, both the latest version, and at least the one prior to that.

The DADS, after receiving the data from the PGS, will routinely transmit data for which standing requests exist to their respective investigators and specially requested data to the original requestor. Transmission can be by electronic means, or by other media. The DADS will also acquire, archive, and distribute Earth Probe data, including TRMM, Landsat-7, and data from other sources such as ADCs.

The IMS is distributed and provides a point of contact from which all DADS-resident data can be requested. It maintains a catalog of all processed data, and directories indicating where they are stored. The catalog will also contain key metadata, allowing potential users to request those data which will best serve their respective investigations. Users will also be able to browse the data before actually ordering them. The browse data are not stored in the IMS, but can be requested by it from the respective DADS for use by the investigators.

In addition to serving as the point of contact for investigators requesting data, the IMS also performs other functions. It sends data requests to the EOC**, its local PGS/DADS**, and to **other** DAACs, it orders data required for the production of scientific products from external sources, and in general provides data production status information. It also provides the users accounting information pertaining to data requests and usage by investigators. The IMS also provides a linkage to information management functions in ADCs to allow users to search for data and products available from ADCs.

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5. ECS System Wide Requirements

This section specifies the requirements which are allocated to the EOSDIS Core System (ECS) as an end-to-end system. The system-wide operational, functional, and performance requirements are specified. The requirements specification for overall system-wide security, reliability, maintainability, and availability (RMA), and ECS external interface elements are also included in this section.

5.1 Operational Requirements

This section specifies the ECS system level operational requirements which describe how the system is to work when built.

EOSD0010 ECS shall use and support the Space Network (SN), **via the Ecom interface,** to obtain the forward and return link data communications needed to achieve full end-to-end ECS functionality.

EOSD0015 ECS shall use and support the Deep Space Network (DSN), the Ground Network (GN), and the Wallops tracking station, **via the Ecom interface,** as backup of the SN, to obtain forward and return link data communications.

EOSD0020 ECS shall use and support the Earth Observing System (EOS) Data and Operations System (EDOS) to obtain the data capture, data archival, and data distribution services needed to achieve full end-to-end ECS functionality.

EOSD0025 ECS shall use Ecom for flight operations data transfers.

EOSD0030 ECS shall provide permanent archiving of EOS and related non-EOS data and products.

EOSD0040 ECS shall provide users without prior approved accounts access to the system for descriptive information about ECS and the types of data it contains.

~~EOSD1700 ECS shall provide access to ECS services only through the IMS at any of the system access nodes.~~

DELETED -- EOSD1700 is a design level requirement and is modified by the addition of APIs.

5.2 Functional Requirements

ECS system level functional requirements are provided in this section. These requirements describe functions to be provided by all ECS elements.

EOSD0500 ECS shall perform the following major functions:

a. EOS Mission Planning and Scheduling
b. EOS Mission Operations
c. Command and Control
d. Communications and Networking
e. Data Input

f. Data Processing
g. Data Storage
h. Data Distribution
i. Information Management
j. End-to-End Fault Management
k. System Management

EOSD0502 ECS shall provide an integrated set of toolkits consisting of software tools for each ECS element.

EOSD0510 ECS shall be capable of being tested during all phases of its development and flight operations.

EOSD0540 ECS elements shall be expandable to facilitate updates in instrument data products and algorithms, particularly with respect to storage capacity and processing capability.

EOSD0545 ECS shall be able to accommodate growth (e.g., capacity) in all of its functions as well as the addition of new functions.

EOSD0560 ECS benchmark tests and test data sets shall be defined for system verification and data quality evaluation.

EOSD0630 ECS shall be capable of simultaneously supporting the Independent Verification and Validation (IV&V) activities and ECS development activities, both before and after flight operations begin.

EOSD0700 Each ECS element shall provide the following, to be used in the revalidation of its functional performance:
a. Benchmark test(s)
b. Standard test data sets.

EOSD0710 Each ECS element shall provide access to the following items used in the checkout and verification process:
a. Stored test data sets
b. Stored test plans
c. Stored test procedures.

EOSD0720 Each ECS element shall be able to validate at any time during the life-time of the ECS that the ECS element primary functional performance is consistent with pre-defined operational benchmark tests.

EOSD0730 Each ECS element shall be capable of verifying the fidelity of the ECS element interface to:
a. Other ECS elements at any time during the lifetime of the ECS
b. Entities external to ECS at any time during the lifetime of the ECS

EOSD0740 Each ECS element shall provide a set of real or simulated functional capabilities for use in the following types of test:
a. Subsystem (components of an ECS element)
b. Element (fully integrated element)
c. ECS System (Integration of ECS elements)

EOSD0750 Each ECS element shall provide a set of real or simulated functions which interfaces with both its ECS internal and external entities for use in the following types of test:

a. Subsystem (components of an ECS element)
b. Element (fully integrated element)
c. EOSDIS System (Integration of EOSDIS elements)

EOSD0760 Each ECS element shall support end-to-end EOS system testing and fault isolation.

EOSD0780 Each ECS element shall be capable of being monitored during testing.

EOSD0800 Each ECS element shall be capable of supporting end-to-end test and verification activities of the EOS program including during the pre-launch, spacecraft verification, and instrument verification phases.

5.3 Performance Requirements

Performance requirements are specified in this section. These requirements describe system capacities, capabilities, and throughput.

EOSD1000 ECS elements shall contribute a loop delay of not greater than 2.5 seconds of the total system delay of five (5) seconds for emergency real-time commands, not including the time needed for command execution. The loop delay is measured from the originator to the spacecraft/instrument and back and only applies when a Tracking and Data Relay Satellite System (TDRSS) link is available for contact to the spacecraft.

EOSD1010 ECS shall support **daily data volume, processing load, storage volume, instrument support, and data traffic** ~~minimum daily average data input rates~~ **as derivable from and** specified in Appendix **C and** D.

EOSD1030 ECS shall have the capacity to accept a daily average of five (5) per cent of the daily data throughput as quick-look data for use in mission operations.

EOSD1040 ECS shall provide sufficient capacity to permit the reprocessing of all EOS science data at twice the incoming data rate at a minimum, concurrently with processing of new data.

EOSD1050 ECS shall generate and make available to the users Level 1 Standard Products within 24 hours after the availability to ECS of all necessary input data sets.

EOSD1060 ECS shall generate and make available to the users Level 2 Standard Products within 24 hours after the availability to ECS of all necessary Level 1 and other input data sets.

EOSD1070 ECS shall generate and make available to the users Level 3 Standard Products within 24 hours after the availability to ECS of all necessary Level 2 and other input data sets.

EOSD1080 ECS shall generate and make available to the users Level 4 Standard Products within one week after the availability to ECS of all necessary Level 3 and other input data sets.

EOSD1140 ECS shall allocate 10% of development resources **(the ECS Sustaining Engineering Facility at GFSC)**, including processing, storage, and networks, for the IV&V activity.

5.4 External Interfaces

ECS external interfaces refer to the interfaces between the ECS elements and the various ECS external support elements, i.e., the supporting elements provided by the EOS project, NASA institutional facilities, cooperating institutions, the user community, and the International Partners.

This section specifies the major system-level external interface requirements. ECS external interfaces are discussed in the following subsections:

a. EOS Project – The external elements included in this category consist of the EOS spacecraft and instruments, the spacecraft simulators, and the Investigator Working Group (IWG).

b. Network and NASA External elements – The external elements included in this category consist of the NASA networks, NASA data systems and archives, the EDOS, the Flight Dynamics Facility (FDF), the TDRSS, and Earth Probe Data Systems (EPDSs).

c. Cooperating Institutions – The external elements included in this category consist of a number of non-NASA institutions such as NOAA.

d. The ECS user community – Users are the ECS participants, other Government agencies, universities and other institutions, and commercial enterprises.

e. International Partners – The external elements included in this category consist of the European Space Agency (ESA), the Space Technology Agency (STA) of Japan, and the Canadian Space Agency (CSA).

5.4.1 EOS Project

Within the framework of applicable international agreements, the IWG will set overall mission priorities and the Program and Project scientists will confirm these priorities.

EOSD1480 ECS shall receive from the resident EOS Project Scientist the IWG's Long Term Science Plan (LTSP) and updates as required.

EOSD1490 ECS elements shall interface with the resident EOS Project Scientist for resolution of conflicts between observations of equal priority.

EOSD1500 ECS shall interface with the EOS spacecraft and with the EOS instruments in order to perform mission operations, including planning, scheduling, commanding, and monitoring functions.

EOSD1680 ECS elements shall receive simulated spacecraft and instrument telemetry and spacecraft flight software loads from the **EOS** spacecraft simulators.

EOSD1690 ECS elements shall provide commands to the **EOS** spacecraft simulators.

EOSD1506 The ECS shall provide access to the V0 system via Level 3 interoperability.

5.4.2 Networks and NASA Elements

EOSD1502 ECS elements shall use Ecom for data communications for the following types of data:

a. Production data sets (Level 0 data)
b. Quick-look production data sets
c. Real-time data (for health and safety)
d. Command data
e. Data requested from back-up archive
f. TDRSS schedule requests
g. Data exchange with the FDF

EOSD1505 ECS elements shall receive EOS spacecraft predicted orbit data and post pass ephemeris determination data from the FDF.

EOSD1510 ECS elements shall provide the FDF with subsets of spacecraft housekeeping data related to the on-board attitude and orbit systems.

EOSD1520 ECS elements shall receive TDRSS schedules from the Network Control Center (NCC).

EOSD1530 ECS elements shall submit TDRSS schedule requests to the NCC.

EOSD1600 The ECS elements that interface with EDOS elements shall exchange element level status data with EDOS.

EOSD1605 ECS elements shall receive from EDOS telemetry data, including housekeeping, engineering, ancillary, and science data from EOS instruments and spacecraft.

~~EOSD1606 ECS shall be designed with a capacity to include data handling functions for those Earth Probe missions for which data system development is not yet underway~~.

DELETED - EOSD1606 cannot be tested or verified, ("not yet underway"), already covered by EOSD1607 and EOSD0545 taken in combination.

EOSD1607 ECS shall receive data for archive and distribution from near-term Earth Probe missions ~~whose data systems are under development~~ **(TRMM, Landsat-7)**.

EOSD1608 ECS elements shall receive from EPDSs the following at a minimum:

a. Data products
b. Ancillary data
c. Calibration data
d. Correlative data
e. Metadata
f. Data information
g. Documentation

5.4.3 Cooperating Institutions

EOSD1710 ECS elements shall exchange with cooperating institutions, such as NOAA and other data processing and archiving facilities, information including the following:

a. Directories
b. Product Orders

c. Order Status
d. Science Data

5.4.4 The ECS User Community

EOSD1720 ECS elements shall receive from the ECS user community the following types of data requests at a minimum:
a. Data Acquisition Requests
b. Data Distribution Requests
c. Reprocessing Requests

EOSD1730 ECS elements shall receive from the ECS user community Special Products, research results, and new derived data sets produced from EOS data.

EOSD1740 ECS elements shall send the following types of data at a minimum to the ECS user community:
a. Metadata
b. Browse data
c. Science data

EOSD1750 ECS elements shall receive data including the following types of supporting information from the ECS science community (TLs, TMs, PIs, and Co-Is):
a. Algorithms
b. Software fixes
c. Instrument calibration data
d. Integration support requests
e. Metadata for Special Products archiving
f. Data transfer requests (inventories, directories, and browse)
g. Data Quality/Instrument assessment
h. Instrument operations information
i. Ancillary data

EOSD1760 The ECS elements shall send the following types of data at a minimum to the ECS science community (TLs, TMs, PIs, and Co-Is):
a. Software Problem Reports
b. Documentation
c. Metadata (copies of inventories)
d. Browse data
e. Archived data
f. Resource unit cost and invoices

5.4.5 International Partners

EOSD1770 ECS elements shall exchange the following types of data at a minimum with the IPs:
a. Instrument command loads
b. Science data
c. Planning and scheduling data
d. Directories
e. Product Orders
f. Status data

5.5 Security

This section contains ECS system-level security requirements applicable to all components of ECS. Additional element-level security requirements may be found in the EOSDIS Science Network (ESN) and System Management Center (SMC) sections of this specification.

The ECS system and elements ~~shall~~ **will** employ security measures and techniques for all applicable security disciplines which are identified in the following documents. These documents ~~shall~~ **will** provide the basis for the ECS security policy. Security documents published by participating EOSDIS organizations (e.g., MSFC, LaRC, JPL) that implement the policy in the following documents are also applicable.

a. National Computer Systems Laboratory (NCSL) Bulletin, Guidance to Federal Agencies on the Use of Trusted Systems Technology, July 1990.

   This bulletin contains the latest multi-user computer system security guidance from the National Institute of Standards and Technology (NIST). The Computer Security Act of 1987 assigns NIST the responsibility for developing security standards and guidelines for most Federal computer systems. NCSL recommends using the National Security Agency (NSA) class C2 security criteria at a minimum for providing discretionary controlled access protection for multi-user computer systems having integrity control requirements. This guidance differs from the prior policy found in the National Telecommunications and Information Systems Security Policy (NTISSP) Number 200. NTISSP Number 200 made C2 security mandatory by 1992. NCSL suggests using the C2 security criteria, but does not say it is mandatory. Additional guidance is expected in the future.

b. NMI 2410.7A, Assuring the Security and Integrity of NASA Automated Information Resources, July 8, 1988.

   This instruction establishes policy and responsibilities for ensuring appropriate levels of security and integrity for NASA automated information processing installations, systems, data, and related resources. It constitutes the NASA Automated Information Security (AIS) Program. It in turn references several "Authority" documents including public laws, executive orders, National Security Decision Directives, OMB Circulars, Federal Regulations, and the NTISSP Number 200 – Access Control Protection.

c. NHB 2410.9, Automated Information Security, Volume I, September 1990.

   This document presents the overall NASA AIS Program, all policies, and all AIS requirements for all automated information, except information which has been determined to be classified for national defense reasons. It presents NASA's method for categorizing information and for determining related sensitivity levels for Automated Information Systems.

d. NHB 2410.1D (as amended) Chapter 3, Privacy and Security for Automated Information Processing Resources, April 1985.

   This document establishes the guidelines and requirements for a NASA Computer Security Program. It identifies the personnel, management, operations, data, and computer systems requirements for NASA programs.

e. NMI 8610.22, National Resource Protection (NRP) Program, December 5, 1989.

This document, with Annex A, NRP System Security Standard, and Consolidated Resource Listing dated October 4, 1990, establishes the NRP requirements for the ECS.

EOSD1990 The ECS system and elements shall employ security measures and techniques for all applicable security disciplines which are identified in the preceding documents. These documents shall provide the basis for the ECS security policy.

5.5.1 Technical Security

Technical security embodies requirements for security management, administrative controls, and access control to computer systems hardware, software, and data.

EOSD2100 The ECS technical security policy planning shall be comprehensive and shall cover at least the following areas:

a. Applicability of the C2 Level of Trustedness as defined by the NSA
b. Applicability of the C2 Object Reuse capability
c. Discretionary control and monitoring of user access
d. ECS communications, network access, control, and monitoring
e. Computer system "virus" monitoring, detection, and remedy
f. Data protection controls
g. Account/privilege management and user session tailoring
h. Restart/recovery
i. Security audit trail generation
j. Security analysis and reporting
k. Risk analysis

EOSD2200 Selection criteria meeting overall ECS security policies and system requirements shall be applied when selecting hardware.

5.5.2 Security Requirements

This section specifies the overall ECS security requirements applicable to all ECS elements. The SMC will have primary responsibility for ECS security management services. In the following requirements, security controlled data are those that have limited access and security protection constraints based on the user authorization level.

EOSD2400 ECS shall provide multiple categories of data protection based on the sensitivity levels of ECS data, **as defined in NHB 2410.9.**

EOSD2430 Data base access and manipulation shall accommodate ~~filtering~~ **control of** user access and update of ~~ECS sensitive information~~ **security controlled data.**

EOSD2440 Data base integrity including prevention of data loss and corruption shall be maintained.

~~EOSD2480 ECS elements shall require unique sessions when security controlled data are being manipulated.~~

DELETED - EOSD2480 is design specific.

EOSD2510 ECS elements shall maintain an audit trail of:

a. All accesses to the element security controlled data

b. Users/processes/elements requesting access to element security controlled data
c. Data access/manipulation operations performed on security controlled data
d. Date and time of access to security controlled data
e. Unsuccessful access attempt to the element security controlled data by unauthorized users/elements/processes
f. Detected computer system viruses **and worms**
g. Actions taken to contain or destroy a virus

EOSD2550 The ECS elements shall limit use of master passwords or use of a single password for large organizations ~~requiring access to a mix of security controlled and non-sensitive data.~~

EOSD2620 ECS elements shall disconnect a user/element after a predetermined number of unsuccessful attempts to access data.

EOSD2640 ECS elements shall relinquish a connection between the element and a user when the user has not been active for a ~~selectable, fixed~~ **configurable** period of time.

EOSD2650 ECS elements shall report **detected** security violations to the SMC.

EOSD2660 ECS elements shall at all times maintain and comply with the security directives issued by the SMC.

EOSD2710 ECS elements shall report all detected computer viruses and actions taken to the SMC.

5.5.3 Contingency Requirements

EOSD2990 The ECS elements shall support the recovery from a system failure due to a loss in the integrity of the ECS data or a catastrophic violation of the security system.

EOSD3000 The **ECS** ~~operating system and associated security capabilities~~ shall provide for security safeguards to cover unscheduled system shutdown (aborts) and subsequent restarts, as well as for scheduled system shutdown and operational startup.

EOSD3200 A minimum of one backup which is maintained in a separate physical location (i.e., different building) shall be maintained for ECS software and key data items (including security audit trails and logs).

EOSD3220 All media shall be handled ~~with care~~ and stored in protected areas with ~~adequate~~ environmental and accounting procedures applied.

5.6 Reliability, Maintainability, Availability

This section specifies the system-level reliability, maintainability, and availability (RMA) requirements for the ECS. The specific RMA requirements stated here are in addition to the overall RMA and other performance assurance requirements of GSFC 420-05-03.

5.6.1 Reliability

EOSD3490 Reliability statistics for ECS shall be collected and monitored using the Mean Time Between Maintenance (MTBM) for each component and operational capability.

EOSD3492 RMA data shall be maintained in a repository accessible for logistics analysis and other purposes.

Mean Time Between Preventive Maintenance (MTBPM) and Mean Time Between Corrective Maintenance (MTBCM) each contribute to the calculation of MTBM.

Failures are defined as those hardware and software malfunctions which result in interruptions in service. ~~Interruptions in service resulting from external factors beyond the control of ECS, such as Ecom circuit failures, shall not be considered failures unless ECS equipment or software contribute to the interruption.~~

EOSD3495 Interruptions in service resulting from external factors beyond the control of ECS, such as Ecom circuit failures, shall not be considered failures unless ECS equipment or software contribute to the interruption.

EOSD3500 The ECS RMA Program shall adhere to GSFC 420-05-03, Performance Assurance Requirements for the EOSDIS.

EOSD3510 Reliability predictions shall be calculated in accordance with the parts ~~stress~~ **count** analysis method, **appendix A,** of MIL-HDBK-217**EF**, Reliability Prediction of Electronic Equipment.

5.6.2 Maintainability

Mean Time To Repair (MTTR) ~~shall include~~ **includes** corrective maintenance time but not logistics and administrative delays inherent in the ECS maintenance process. Logistics delays include the time required to provide replacement units at the failure location (replacement units ~~shall~~ **will** be presumed to be available on-site). Administrative delays ~~shall~~ **will** include the time required for maintenance personnel and test equipment to arrive at the failure location. ~~Corrective maintenance time is the sum of corrective maintenance times, divided by the total number of failures.~~ Corrective maintenance ~~shall~~ ~~include~~ **includes** the time required for troubleshooting, fault localization, removal and replacement of failed line replaceable units (LRU), adjustment/recalibration of repaired equipment, and verification that the specified performance requirements are met.

Mean Down Time (MDT) includes Preventive Maintenance (PM) **down** time and MTTR plus all delays which prevent the system from returning to an available state, including active repair time, administrative delays, and logistics delays. MDT for ECS components may actually be switchover time to a backup component rather than the time to get the downed component running again. If the MDT for an ECS component is sufficiently small, then a backup capability is required to satisfy the MDT requirement. In such cases the actual down time of a component is of secondary importance when compared to providing a backup capability that can take over for the downed component in the MDT timeframe. In such cases the measured down time of the downed component is the actual switchover time. Of course the downed component must be made available again in a timely fashion to guard against a second failure, in order to satisfy the availability requirement for the component.

EOSD3600 Maintainability shall be predicted in accordance with MIL-HDBK-472, Maintainability Prediction, **Procedure II**.

EOSD3610 The Maintainability Status Report shall be based on MIL-STD-470A, Maintainability Program for Systems and Equipment, Task 104 and shall include any changes in the ~~MTBF~~ **MTBM** predictions.

EOSD3615 The Maintainability Status Report shall also include data on items specified for maintainability reporting in GSFC 420-05-03.

EOSD3620 ECS shall predict and periodically assess maintainability by measuring the actual MDT and comparing to the required MDT.

EOSD3625 For ECS functions with a backup capability, ECS shall use switchover time to the backup capability in measuring maintainability, rather than down time, when the component goes down.

EOSD3630 The maximum down time shall not exceed twice the required MDT in 99 percent of failure occurrences.

5.6.3 Operational Availability

Operational availability is defined as the fraction of time an operational capability is ready for use when needed, over the entire life cycle of the equipment. Operational availability for ECS, Ao, is defined as follows:

$$Ao = \frac{MTBM}{MTBM + MDT}$$

5.6.4 ECS System-level RMA

EOSD3700 ECS functions shall have an operational availability of 0.96 at a minimum (.998 design goal) and an MDT of four (4) hours or less (1.5 hour design goal), unless otherwise specified.

The above requirement covers equipment including:

a. "Non-critical" equipment configured with the critical equipment supporting the functional capabilities in the requirements

b. Equipment providing other functionality not explicitly stated in the RMA requirements that follow.

The RMA requirements in the remainder of this section pertain to equipment required to support the functional capabilities stated in the requirements.

5.6.4.1 Flight Operations Segment (FOS) RMA

EOSD3800 The FOS shall have an operational availability of 0.9998 at a minimum (.99997 design goal) and an MDT of one (1) minute or less (0.5 minute design goal) for critical real-time functions that support:

a. Launch
b. Early orbit checkout
c. Disposal
d. Orbit adjustment
e. Anomaly investigation
f. Recovery from safe mode
g. Routine real-time commanding and associated monitoring for spacecraft and instrument health and safety

EOSD3710 The ECS shall have no single point of failure for functions associated with real-time operations of the spacecraft and instruments.

EOSD3810 The FOS shall have an operational availability of 0.99925 at a minimum (.99997 design goal) and an MDT of five (5) minutes or less (0.5 minute design goal) for non-critical real-time functions.

EOSD3820 The FOS shall have an operational availability of 0.992 at a minimum (.99997 design goal) and an MDT of one (1) hour or less (0.5 minute design goal) for functions associated with Targets Of Opportunity (TOOs).

5.6.4.2 Science Data Processing Segment (SDPS) RMA

The RMA requirements for the product generation function refer to a failsoft environment. In a failsoft environment the product generation function continues in degraded mode when a product generation computer fails since the remaining computers continue to produce products.

EOSD3900 The SDPS function of receiving science data shall have an operational availability of 0.999 at a minimum (.99995 design goal) and an MDT of two (2) hours or less (8 minutes design goal).

EOSD3910 The switchover time from the primary science data receipt capability to a backup capability shall be 15 minutes or less (10 minutes design goal).

EOSD3920 The SDPS function of archiving and distributing data shall have an operational availability of 0.98 at a minimum (.999999 design goal) and an MDT of two (2) hours or less (9 minutes design goal).

EOSD3930 The user interfaces to Information Management System (IMS) services at individual Distributed Active Archive Center (DAAC) sites shall have an operational availability of 0.993 at a minimum (.9997 design goal) and an MDT of two (2) hours or less (1.6 hour design goal).

EOSD3940 The SDPS function of Information Searches on the ECS Directory shall have an operational availability of 0.993 at a minimum (.9997 design goal) and an MDT of two (2) hours or less (1.4 hour design goal).

EOSD3950 The SDPS function of Data Acquisition Request (DAR) Submittal including TOOs shall have an operational availability of 0.993 at a minimum (.999999 design goal) and an MDT of two (2) hours or less (6 minutes design goal).

EOSD3960 The SDPS function of Metadata Ingest and Update shall have an operational availability of 0.96 at a minimum (.999999 design goal) and an MDT of four (4) hours or less (6 minutes design goal).

EOSD3970 The SDPS function of Information Searches on Local Holdings shall have an operational availability of 0.96 at a minimum (.999999 design goal) and an MDT of four (4) hours or less (6 minutes design goal).

EOSD3980 The SDPS function of Local Data Order Submission shall have an operational availability of 0.96 at a minimum (.999999 design goal) and an MDT of four (4) hours or less (6 minutes design goal).

EOSD3990 The SDPS function of Data Order Submission Across DAACs shall have an operational availability of 0.96 at a minimum (.999999 design goal) and an MDT of four (4) hours or less (6 minutes design goal).

EOSD4000 The SDPS function of IMS Data Base Management and Maintenance Interface shall have an operational availability of 0.96 at a minimum (.999999 design goal) and an MDT of four (4) hours or less (6 minutes design goal).

EOSD4010 Each computer providing product generation shall have an operational availability of 0.95 at a minimum (.9995 design goal).

EOSD4020 At each DAAC site, the product generation functional capabilities shall be spread across multiple product generation computers thereby providing a "failsoft" environment.

5.6.4.3 Communications and System Management Segment (CSMS) RMA

The SMC RMA requirements have been divided into two categories, critical and non-critical. Critical services are those necessary to ensure the SMC can operate on a 24 hour per day basis and those necessary for interactions with the ECS elements to maintain the ECS mission. These critical services include the resource management of the configuration management service, the performance management service, the fault management service, the security management service, and directory services. Non-critical services include the scheduling service and all functions of configuration management except the resource management service, accounting/accountability service, and report generation service.

EOSD4030 The SMC function of gathering and disseminating system management information shall have an operational availability of .998 at a minimum (.999998 design goal) and an MDT of 20 minutes or less (5 minutes design goal), for critical services.

EOSD4035 The ESN shall have no single point of failure for functions associated with network databases and configuration data.

EOSD4036 The ESN operational availability shall be consistent with the specified operational availability of the ECS functions.

5.6.5 Fault Detection and Isolation Requirements

EOSD4100 The ECS segments, elements, and components shall include the on-line (operational mode) and off-line (test mode) fault detection and isolation capabilities required to achieve the specified operational availability requirements.

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6. Flight Operations Segment (FOS)

6.1 Overview

The Flight Operations Segment (FOS) is responsible for EOS mission operations, including the planning, scheduling, commanding, and monitoring of U.S. spacecraft and U.S. EOS instruments onboard the U.S. and International Partner (IP) series of spacecraft. The portion of the FOS that is implemented by the ECS contract is limited to the operation of the EOS spacecraft and instruments that are controlled from GSFC as listed in Table D-1. The remainder of this section addresses only the ECS subset of the FOS. The design of the FOS should not preclude the FOS architecture from being expanded to accommodate future EOS spacecraft and instruments; it should have the hooks to anticipate future mission support.

The FOS is composed of the EOS Operations Center (EOC), Instrument Control Centers (ICCs) located at GSFC, and Instrument Support Terminals (ISTs) associated with the GSFC ICCs.

The EOC is the EOS mission control center, and as such, it is responsible for the high-level monitoring and control of EOS mission operations. The EOC will coordinate the operation of all instruments onboard the first U.S. spacecraft. The EOC is responsible for coordinating multi-instrument, multi-organization observations, and will resolve any scheduling conflicts that exist between the instruments/organizations. When necessary, the Project Scientist or his designee, who is resident at the EOC, will provide the final science conflict resolution. However, the EOC Operations Manager will have ultimate authority in decisions regarding spacecraft and instrument health and safety. The EOC will generate a ~~Conflict-Free Schedule (CFS)~~ **detailed activity schedule** for the spacecraft, based on observation requests received from each of the ICCs and information received from the Network Control Center (NCC) and the Flight Dynamics Facility (FDF). It will merge instrument command data received from each of the ICCs, and perform high-level validation to ensure that no resources or other constraints have been exceeded. The EOC will then forward the instrument command data together with the spacecraft command data to the Earth Observing System (EOS) Data Operations System (EDOS) for actual uplink to the spacecraft. It will maintain spacecraft and instrument health and safety, monitor spacecraft performance, perform spacecraft sustaining engineering analysis, perform high-level monitoring of the mission performance of the instruments, and provide periodic reports to document the operations of the spacecraft/instruments.

ICCs are responsible for planning, scheduling, commanding, and monitoring the operations of instruments. Each will work with the EOC in planning and scheduling the use of spacecraft resources to support the desired operation of its instrument based on internal observation requests and those received from the general science community. ICCs will generate the instrument command data necessary to implement the desired schedule. They will also perform around-the-clock health and safety monitoring for their instrument.

ISTs provide interfaces between the Principal Investigators (PIs)/Team Leaders (TLs) and the ICCs. An IST provides access to the ICC functions for those individuals who are not physically located at the ICC. It enables PIs and TLs to participate in the planning, scheduling, commanding, and monitoring of their instruments. The IST is capable of performing a subset of the functions available at the ICC. These functions are available through a terminal or workstation at the PI/TL and/or other designated sites.

The following assumptions are made regarding the functionality required of the FOS elements:

The interface between the FOS and IPs ~~shall~~ **will** be defined in a Memorandum of Agreement. For the purpose of this document, the following specific assumption is made:

- For IP instruments on the U.S. spacecraft, the IPs will have an element (IP ICC) that is functionally equivalent to the ICCs for U.S. instruments on the U.S. spacecraft. The U.S. EOC can expect to interface with the IP ICCs in a manner that is similar to the interface between the U.S. EOC and U.S. ICCs.

6.2 FOS Architecture

The FOS is composed of two elements, the EOC and the ICCs. These elements, together with the ISTs, which are subelements of the ICC elements, interact functionally to plan, schedule, command, and monitor the operation of the EOS instruments and the spacecraft.

The FOS interfaces with EDOS. EDOS is an institutional capability being developed by the EOS Program to provide a set of functions for data handling, data processing, and data distribution services. The FOS will forward all spacecraft and instrument command data to EDOS for uplink. EDOS will provide spacecraft housekeeping data, instrument engineering data, and selected science quick-look data in CCSDS packets to the FOS for use in spacecraft and instrument health and safety monitoring.

The FOS interfaces with the spacecraft simulators to support simulated spacecraft operations.

The FOS interfaces with the IPs, who are also participants in the EOS program. The FOS will support the operation of IP instruments flying on the spacecraft. Memoranda of Agreement exist that detail each agency's participation in these activities. For the purpose of this document, it is assumed that the IPs will have elements that are functionally equivalent to the ICC.

The FOS interfaces with several ECS elements. The interface with the Systems Management Center (SMC) provides system status information used by the SMC in maintaining overall status of the ECS, and provides selected input to the reports prepared by the SMC. The SMC also provides IWG plans and guidelines to the FOS elements through this interface. The interface with the Science Data Processing Segment (SDPS) provides new data acquisition requests to the FOS, as well as processed science quick-look data for instrument health and safety monitoring. The FOS in turn provides plans and schedules to the SDPS for planning purposes and provides historical data to the SDPS for archiving.

The FOS uses Ecom to communicate with non-ECS elements (e.g., EDOS) and ESN to communicate with other ECS elements. Internal to the FOS, the EOC and the ICC interface to each other using Ecom and the ISTs are connected to the ICC via the ESN.

The following sections describe the FOS architecture in more detail.

6.2.1 Context View

The interfaces between the FOS and the major systems and elements external to it are reflected in the Conceptual FOS Context Diagram in Figure ~~6.2.1-1~~ **6-1**. These interfaces, and the data being exchanged between them, are explained briefly in the following paragraphs.

The FOS coordinates the planning and scheduling of spacecraft system operations and EOS instrument operations within the resource constraints of the spacecraft. Once a ~~CFS~~ **detailed activity schedule** has been generated, the FOS provides validated spacecraft and instrument command data in CCSDS transfer frames to EDOS for uplink to the spacecraft.

The FOS interfaces with EDOS to receive CCSDS packets containing spacecraft housekeeping and instrument engineering data as well as quick-look science data. The data received from EDOS arrives in a real-time or expedited manner with minimum processing occurring on the data before its receipt by the FOS.

The FOS interfaces with IP ICCs to coordinate the operation of IP instruments on the U.S. spacecraft. The FOS provides resource constraints to the IP ICCs and coordinates the planning and scheduling of IP instruments. Once the FOS has generated a ~~CFS~~ **detailed activity schedule** for the U.S. spacecraft, it will receive validated instrument command data from the IP ICCs. The FOS will provide general spacecraft status information to the IP ICCs, and the IP ICCs will provide general instrument status information to the FOS.

The FOS interfaces with the spacecraft simulators to accept spacecraft software memory loads and to conduct simulated operations.

The FOS interfaces with the SDPS to receive data acquisition requests (DARs) for future observations that are used in planning and scheduling instrument operations on the spacecraft. The FOS maintains the status of each request, and provides status to the SDPS upon request. The FOS provides planning and scheduling information to the SDPS for use with data processing elements. The FOS also provides historical information, reports, and status information to the SDPS for archiving. When desired by an ICC, the SDPS can provide processed science quick-look data to the appropriate ICC on an expedited basis for instrument monitoring.

The FOS interfaces with the FDF to exchange orbit and attitude information for controlling the spacecraft and instruments.

The FOS interfaces with the Network Control Center (NCC) to request Tracking and Data Relay Satellite System (TDRSS) services and to obtain the actual TDRSS schedules in return.

Finally, the FOS interfaces with the SMC to exchange information used by the SMC in maintaining and reporting on the current status of the ECS ground system. The SMC also provides IWG information to the FOS, including science policy, guidelines, and priorities for use by the FOS in planning and scheduling instrument observations.

6.2.2 Physical View

The physical architecture of the FOS segment is as follows:

The FOS will be located at Goddard Space Flight Center (GSFC) in Greenbelt, Maryland.

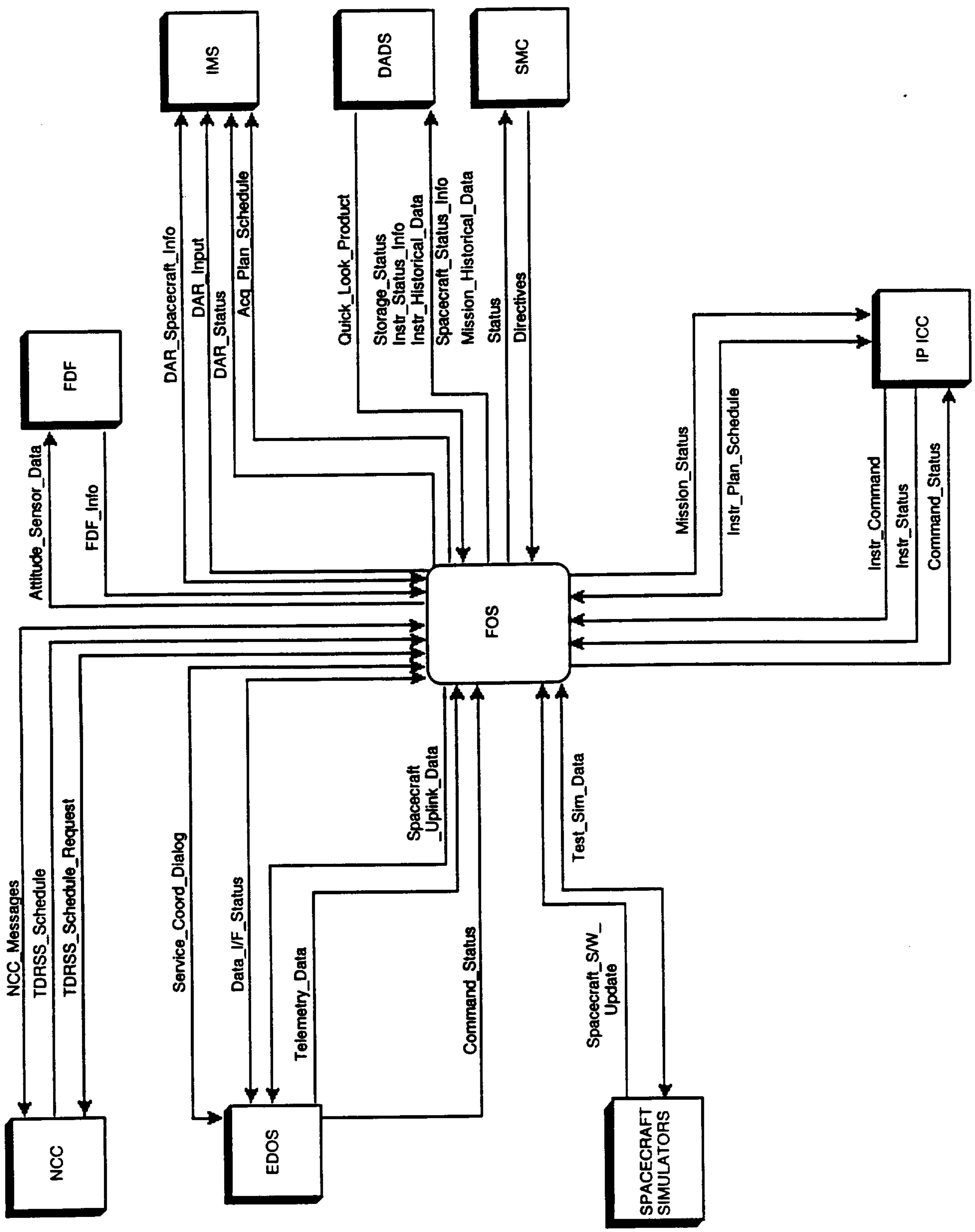


Figure 6-1. Conceptual FOS Context Diagram

~~The Instrument Control Facility (ICF) is composed of ICCs for the instruments assigned to the facility.~~ The design of the FOS ~~shall~~ **will** not preclude the existence of additional ~~ICFs~~ **ICCs.**

It is planned that there will be one IST per instrument, with the locations of each IST at the PI/TL site. However, the design of the FOS ~~shall~~ **will** not preclude the provision of additional ISTs if desired by a PI/TL to accommodate Co-Investigators and Team Members, who may be at geographically separate locations, but are required to support the operations of the instrument. The capabilities available at the IST will be provided as a software toolkit that can run at a user-provided terminal or workstation.

6.3 Operational View

The following paragraphs briefly describe the operations of the FOS and the interoperability between the FOS elements.

The FOS is responsible for operating the U.S. spacecraft and U.S. EOS instruments, including planning, scheduling, commanding, and monitoring of the spacecraft and the U.S. instruments and coordination of all instrument operations onboard the U.S. spacecraft. These functions occur simultaneously at any given time. For example, today, a plan may be generated for next month while a schedule is generated for this week and commands are generated for tomorrow and monitoring is performed for operations occurring today.

The planning function requires input from various external sources and results in specific actions by the FOS elements. The IWG meets periodically and provides policy, guidelines, and priorities to be used by EOSDIS in operating EOS instruments and processing acquired data. This information is made available by the SMC to the EOC and ICCs. This information is used by the EOC and ICCs in formulating future plans. ~~Every week, the FOS generates an operations plan for the next 28 days, using this IWG information along with other planning information, including~~ **The plans and schedules contain instrument collection requirements, instrument support activities and spacecraft subsystem operations, in addition to** Data Acquisition Requests (DARs) submitted by science users. These requests may be from PIs/TLs or the science community in general. All DARs are submitted through the IMS and forwarded to the ~~EOC~~ **ICC** for analysis and inclusion in future plans. ~~The EOC forwards these requests to the appropriate ICC for final analysis.~~

Every week, the ICC will generate a ~~Short-Term Instrument Plan (STIP)~~ **an instrument resource profile or an instrument resource activity deviation list** covering the operation of its instrument for ~~the next 28 days~~ **a target week.** The ICC will generate the ~~STIP~~ **resource requests** based on IWG guidelines, accepted DARs, **collection requests,** and ~~Instrument Support Activity Requests (ISARs)~~ **instrument support activities** identified by the instrument operations team and other planning information that may be available from the EOC. It will forward the ~~STIP~~ **instrument resource profile or instrument resource deviation list** to the EOC, which ~~integrates the STIPs from each ICC into a Short-Term Operations Plan (STOP) for the spacecraft~~ **incorporates it into the preliminary resource schedule for the overall spacecraft and instruments.** The EOC will iterate with the ICCs as necessary to resolve any conflicts. ~~The EOC provides the STOP to the SMC and IMS.~~

~~7.5.1 Distributed Active Archive Center (DAAC)~~

~~7.5.1.1 Overview~~

~~This section provides a general description of DAAC sub-elements and functions, and their interfaces with other EOSDIS segments and the external systems. It also discusses the role of DAAC within the SDPS.~~

~~7.5.1.2 DAAC Architecture and Interfaces~~

~~Eight DAAC sites will be established for data processing, archiving, and distribution of EOS instrument data. Each DAAC will interface with other DAACs for the purpose of exchanging EOS data products. Locations of the proposed DAACs are shown in Figure 7-2.~~

~~The DAAC is composed of two sub-elements, the PGS and DADS. The PGS is charged with Standard Product generation, and the DADS is responsible for archival and distribution of Standard Products.~~

~~The PGS coordinates with the DADS for locating required data products based on the product order that is initiated from the IMS. The PGS provides the DADS with the processed data products for archiving. The PGS also generates quick-look products for distribution to selected users for further analysis. The DADS provides the PGS with algorithms, ancillary data, quick-look data, and Level 0-4 data products, necessary for the production of standard and quick-look products. The PGS will be informed via the data availability schedule from the EDOS and the IPs of the probable arrival time of Level 0 data, quick-look data and spacecraft ancillary data at the DADS. The DADS coordinates with the EDOS and the IPs for acquiring Level 0 data, quick-look data, and spacecraft ancillary data.~~

~~Figure 7.5.1.2-1 illustrates the conceptual DAAC context and relationships with the EOSDIS internal and external systems. The DAAC provides the IMS with metadata, product status, schedule, and data interpretation documentation. The DAAC receives the product order, and product status request from the IMS for identifying and distributing the desired data and data products. The DAAC provides the users with test products, data products, documents, algorithms, correlative data, ancillary data, and metadata. As a result, the DAAC receives product quality assessment, algorithm updates, test product reviews, and quality assessment of metadata. The DAAC stores research results, new data sets, documents, correlative data, ancillary data, and metadata received from the users.~~

~~The DAAC provides the ICC with the quick-look products for further assessment of the operational status of spacecraft and instruments, and the quality of received instrument data. The DAAC receives instrument status data from the ICC. The DAAC archives spacecraft status data and mission historical data that are sent from the EOC. The DAAC provides the SMC with the resource status for system configuration monitoring and control. The DAAC receives refined attitude and orbit information from the FDF. The DAAC interfaces with the SCF for algorithm development, product documentation, metadata generation, and special data products generation.~~

Every day, the FOS will generate a ~~Conflict-Free Schedule (CFS)~~ **detailed activity schedule** that covers the next ~~7~~ **several operational** days. The ICCs will generate ~~Instrument Activity Specifications (IASs) based on the STOP plus any updates [including Targets of Opportunity (TOOs)], which it will forward to the EOC~~ **instrument activity lists or instrument activity deviation lists based on the preliminary resource model.** The EOC will integrate the ~~IASs~~ **instrument activity lists or instrument activity deviation lists** from each of the ICCs into a ~~CFS~~ **detailed activity schedule,** incorporating the spacecraft subsystem activities and resolving any conflicts that exist between the planned instrument operations. The Project Scientist or designee, who is resident at the EOC, will be the final authority for resolving all science conflicts. The EOC provides the ~~CFS~~ **detailed activity schedule** to the ICC, SMC, and IMS.

Upon receipt of a ~~CFS~~ **detailed activity schedule** from the EOC, the ICCs will generate and validate the instrument commands necessary to support the schedule. The ICCs will forward the commands to the EOC, where they will be integrated with the commands for the other instruments and for the spacecraft. The EOC will generate the commands for the spacecraft subsystems. The EOC will perform high-level validation to ensure that no resources or other constraints have been exceeded, and will forward the commands to EDOS for uplink.

The EOC will receive communication status from EDOS, which it will forward to the ICCs to support instrument operations. The EOC will also generate general spacecraft status information for high-level monitoring of spacecraft. The ICCs will receive spacecraft and instrument engineering data and selected science quick-look data from EDOS. An ICC can also receive certain science quick-look data processed by the SDPS.

The ICCs are responsible for the health and safety monitoring of their instruments. An ICC is capable of "safing" its instrument after identifying an emergency condition. An ICC, supported by the PIs/TLs at the IST, will also perform anomaly investigations and trend analyses to determine the performance of its instrument. The ICC will provide general instrument status information to the EOC.

The EOC is responsible for the monitoring of the spacecraft status and for the high-level monitoring of instrument operations on a spacecraft level. It will use the status information that it receives from the ICCs and EDOS to accomplish this function. The EOC will be capable of safing spacecraft subsystems and also an instrument in the event that an ICC is incapable of doing so.

The EOC will periodically generate reports, including operational histories and other general status reports. Additionally, the EOC will provide requested inputs to the SMC for inclusion in the status reports generated by the SMC. These reports, along with spacecraft status information, will be sent by the EOC to the SDPS for archiving. The ICCs will also send instrument status information to the SDPS for archiving.

The EOC ~~shall~~ **will** operate 24 hours a day, with some functions, such as planning, not supported by all shifts. The ICCs are also expected to operate 24 hours a day, with similar reductions in support during non-normal hours. ISTs will operate as desired by the appropriate PI/TL, and therefore may not support around the clock operations.

For the purpose of this document, a TOO is an event or phenomenon that cannot be fully predicted in advance, thus requiring timely system response or high-priority processing. This definition is the traditional control center view of TOOs and is reflected throughout this document. An event that requires a change only to a long-term plan is not considered to be a TOO because it can be handled without perturbing the scheduling system.

Late changes to scheduled activities will be evaluated on a case by case basis. An attempt will be made to accommodate them based on their priority, available resources, and impact to other scheduled activities. Performance requirements for late changes are not specified in this document, since they are accommodated by performance requirements for TOOs.

6.4 FOS Requirements

The following requirements apply to all FOS elements.

FOS-0020 The FOS shall provide a training mode of operation for use during operator training **and/or user training** that does not interfere with ongoing operations. \\1121\\

FOS-0025 The FOS shall provide a test mode of operation that does not interfere with ongoing operations, and which supports independent element and subsystem tests, end-to-end tests, and integration and verification activities occurring during at a minimum:

a. Spacecraft and instrument integration and test

b. Pre-launch

c. Upgrades and enhancements

\\~~1260~~,1261,**1322,** ~~1347~~\\

FOS-0030 The FOS shall adopt an extensible general-purpose scheduling language for communicating planning and scheduling information between FOS elements. \\~~TBD~~ **1016, 1383**\\

FOS-0040 The FOS shall be capable of supporting flight operations of the **EOS** spacecraft and instruments as listed in Table D-1. \\1143, **1391**\\

FOS-0045 The FOS shall be capable of being expanded to support the simultaneous flight operations of an EOS spacecraft and its replacement with no impact to the design. \\~~TBD~~ **1324**\\

FOS-0050 The FOS design shall include hooks to allow the FOS to support additional EOS spacecraft and U.S. instruments without major redesign. \\~~TBD~~ **1324**\\

FOS-0060 The design of the FOS shall not preclude the existence of additional ICCs.

FOS-0070 The design of the FOS shall not preclude the provision of additional ISTs if desired by the PI/TL to accommodate Co-Investigators and Team Members, who may be at geographically separate locations.

6.5 FOS Elements

The FOS consists of two elements and one subelement. The two elements, the EOS Operations Center (EOC) and the Instrument Control Center (ICC), are described in detail in Sections 6.5.1 and 6.5.2, respectively. The subelement, the IST, is described in Sections 6.5.2.1.10

and 6.5.2.3.10. Note that the term "resource" is used throughout this section. It includes environmental rights and privileges (i.e., the environmental effects of spacecraft or instrument activities such as the right to produce or the privilege of being free of magnetic interference) as well as resources in the more conventional sense (such as power or data bandwidth).

6.5.1 EOS Operations Center (EOC)

6.5.1.1 Overview

The EOC serves as the control center for the U.S. EOS spacecraft and coordinates mission operations for EOS instruments onboard the U.S. spacecraft. The EOC will support the EOS mission life cycle, including prelaunch tests, launch, on-orbit operations, training, and tests (interface, system, and end-to-end). The EOC will be capable of supporting operations in parallel with tests, simulations, upgrades, training, maintenance, and sustaining engineering activities. The EOC will be capable of evolving over the lifetime of the EOS mission to accommodate changes in the mission and changes in control center technology. The EOC will be modular, use communications standards, and use maintainable and transportable software. The EOC will use automation where it increases productivity, reduces operations risk, or reduces costs. The initial design ~~shall~~ **will** have growth paths where automation can be easily introduced later in the mission lifetime.

There is one EOC located at GSFC that is responsible for coordinating the operations of all EOS instruments, U.S. or IP, for the U.S. spacecraft in addition to the operations of the U.S. spacecraft. It is assumed that for an IP instrument on a U.S. spacecraft, the IP provides an ICC with the EOC interface similar to the interface between the EOC and U.S. ICCs. (See assumption in Section 6.1.)

The EOC provides ~~nine~~ **eight** services: ~~DAR processing,~~ planning and scheduling, command management, commanding, telemetry processing (which includes mission monitoring), spacecraft and instrument analysis and management, data management, element management, and user interface. The combination of all ~~nine~~ **eight** services provides for EOC normal operations as well as accommodating late changes for emergencies and contingencies, including TOOs. TOOs are defined from a control center point of view as late changes to schedules to accommodate science requests. Each of these services is described briefly below. More detailed requirements for these services are presented in Section 6.5.1.3.

~~6.5.1.1.1 DAR Processing Service~~

~~A DAR is a request for future data acquisitions that the user constructs and submits through the IMS. The DAR processing service receives DARs from the IMS and performs high-level checks beyond the reasonability checks that the IMS performs before requesting that the appropriate ICC(s) analyze them further. Errors or conflicts may be detected through checks at the EOC or at the ICC at any level in the processing of the DAR. The resolution of these errors or conflicts will be attempted locally. If they cannot be resolved locally, they may require consultation with the requester, and may ultimately require resolution by the Project Scientist or his designee. A DAR may be rejected for reasons such as unresolvable conflict or lack of sufficient information. Such rejection may occur at any of the various phases of the processing from initial input through planning and scheduling of the DAR. A DAR is said to be "accepted" at a particular~~

~~phase in the process when it meets the requirements of that phase. It may be accepted at one phase, but rejected at a later phase. Until it is implemented on the spacecraft and instruments, it is subject to being later deferred or rejected.~~

~~DARs may require coordinated observations by two or more instruments; the EOC is responsible for ensuring that these coordinated observations are properly implemented. The EOC maintains the status of DARs. DAR status is provided to the IMS upon initial determination of acceptance or rejection of the DAR, upon change to the DAR or DAR status, or upon request. A DAR is typically accepted for processing up to 28 days before the time of observation, although approved late DARs such as those for TOOs (see Section 6.5.1.1.2) can be accepted. The 28-day deadline is a product of the planning and scheduling process that accommodates institutional facilities (e.g., NCC, FDF).~~

6.5.1.1.2 Planning and Scheduling Service

The Planning and Scheduling Service generates **the integrated** plans and schedules **for spacecraft and instrument operations. The instrument plans and guidelines are** based on the Investigator Working Group (IWG) ~~plans and guidelines included in the~~ Long-Term Science Plan (LTSP) and Long-Term Instrument Plan (LTIP), obtained via the SMC, **while spacecraft plans and guidelines are based on the long-term spacecraft operations plan. In addition, the plans and schedules are dependent upon** ~~as well as~~ DARs, ~~ISARs~~ **instrument support activities**, and Spacecraft ~~Core Activity Requests (SCARs)~~ **subsystem activities.** ~~It~~ **The Planning and Scheduling Service** coordinates multi-instrument observations and exchanges information with the ICCs for instrument operations. There will be an integrated scheduler at the EOC for instrument and spacecraft operations, which may be augmented by instrument-specific scheduling tools. The EOC scheduler will be available to the ICCs for use in their own detailed scheduling and for performing "what if" analysis. The EOC scheduler will have two modes, ~~comprehensive ("batch")~~ **batch** and incremental **interactive-user** scheduling. A common flexible request notation, including a planning and scheduling language, protocols, and data formats for interactions between the EOC and ICCs will be used to minimize the number of iterations. Authorized users will have access to view all planning and scheduling information, available across EOC and ICCs boundaries. ~~Common automated tools~~ **A common set of capabilities** for formulating requests and visualizing plans and schedules for use at the EOC and ICCs will be provided. As a part of the Planning and Scheduling Service, the Project Scientist or designee at the EOC may be requested to resolve instrument scheduling conflicts while ensuring that EOS mission science objectives are met. The EOC reintroduces applicable requested activities into its planning and scheduling function when the activity did not occur due to a deviation from the schedule. The applicable requests, referred to herein, are those that include sufficient flexibility to be rescheduled and have prior authorization from the requester. Plans and schedules are provided to the IMS as user information.

The EOC receives from the FDF predicted orbit data, including **associated uncertainties and** predicted ground track information for scheduling~~, and contact scheduling data, including~~**. In addition, the FDF supplies** User Antenna View (UAV) data and Predicted Site Acquisition Tables (PSATs) **for contact scheduling**. The EOC assists the FDF in developing plans for corrective firings for orbit ~~adjusts~~ **maneuvers** that the EOC then schedules and implements. The EOC transmits schedule requests to the Network Control Center (NCC), receives TDRSS active schedules from the NCC, and exchanges planning and scheduling messages with the NCC. The EOC manages spacecraft resources that are not managed onboard, including the scheduling of the ~~high-rate tape~~ **spacecraft** recorders **and communication subsystems.**

The EOC ~~plans~~ **performs planning for** spacecraft operations and integrates **all of the** spacecraft and instrument plans and schedules. The planning and scheduling process is one of refinement and specification of more detail to earlier versions of plans and schedules. The following is a brief summary of the terminology used in planning and scheduling for this document.

The LTSP is generated by the IWG and contains guidelines, policy, and priorities. It is generated/updated approximately every 6 months and covers a period of up to approximately 5 years. The LTIP is also generated/updated by the IWG, although more likely by the instrument's representative on the IWG, and provides instrument-specific information. Its time characteristics are the same as those of the LTSP. The SMC will notify the EOC or other ECS elements when new LTSPs and LTIPs are received. The ~~STIP~~ **instrument resource profile is** generated/updated weekly by the ICCs, covering ~~the next 28 days~~ **a target week,** and produced ~~the week before the start of the 28-day period~~ **several weeks in advance of the target week.** It is based on DARs, ~~ISARs~~ **instrument support activities**, the previous ~~STIP~~ **instrument resource profile**, the LTSP, the LTIP, and resource availability and guidelines from the EOC. The EOC integrates the ~~STIPs~~ **instrument resource profiles with its spacecraft subsystem resource profile**, producing the ~~STOP~~ **preliminary resource model**, also generated weekly, covering ~~28 days~~ **the following target week.** The ICCs respond by generating an ~~Instrument Activity Specification (IAS)~~ **instrument activity list** based on the ~~STOP~~ **preliminary resource model. The instrument activity list is** generated daily, covering ~~a 7-day period~~ **the next several days.** The EOC generates ~~spacecraft core~~ activity specifications based on the ~~STOP~~ **preliminary resource model** and late arriving ~~SCARs~~ **spacecraft subsystem activities**. The EOC integrates the ~~IASs~~ **instrument activity lists** and ~~spacecraft core~~ activity specifications to form the ~~CFS~~ **detailed activity schedule**, generated daily, covering ~~a 7-day period~~ **the next several days**. The ~~CFS~~ **detailed activity schedule** can be modified for a TOO up to 24 hours before an observation. A TOO requiring no schedule changes can be accepted up to 6 hours before the observation; a TOO that requires only real-time commands can be accepted 1 hour before the next TDRSS contact. TOOs or other late changes of sufficiently high priority and/or low impact could be accommodated in a shorter time interval, when possible.

6.5.1.1.3 Command Management Service

The Command Management Service provides management of preplanned uplink data for the EOS spacecraft and EOS instruments based primarily on the detailed activity schedule. The preplanned uplink data include instrument data received from an ICC and spacecraft data generated by the Command Management Service. It performs high-level validation on and transforms ~~core-stored~~ **Spacecraft Controls Computer (SCC) stored** commands, spacecraft software memory loads, ~~core-stored~~ **SCC-stored** table loads, and instrument microprocessor memory loads into a form ready for use on the spacecraft and instruments. ~~Core-stored~~ **SCC-stored** commands are either spacecraft or instrument commands stored on the spacecraft to be executed as directed by the ~~central onboard computer (OBC)~~ **SCC.** A spacecraft software memory load is an update to the spacecraft software provided by the spacecraft simulator. A table is a predefined set of contiguous data that is routinely updated. A ~~core-stored~~ **SCC-stored** table load may be associated with the spacecraft or an instrument. The service also provides high-level validation for preplanned command groups, which are stored on the ground in preparation for real-time execution.

The Command Management Service accepts ~~core-stored~~ **SCC-stored** instrument commands, ~~core-stored~~ **SCC-stored** instrument tables, and instrument microprocessor memory loads from the ICCs and validates them at a high level for appropriateness, checking for authorized sources, and checking for violation of selected constraints. It uses project-supplied information regarding command definition and validation. The contents of the instrument microprocessor memory loads, which could include microprocessor-stored tables or microprocessor-stored commands, are managed by the respective ICCs.

The Command Management Service generates and validates ~~core-stored~~ **SCC-stored** spacecraft commands and ~~core-stored~~ **SCC-stored** spacecraft tables based on the schedule. It integrates the ~~core-stored~~ **SCC-stored** spacecraft and instrument commands in preparation for uplink, managing spacecraft computer stored command memory, packaging commands for onboard storage, and producing a memory map for the spacecraft stored command processor. ~~It keeps the commands for each instrument and the spacecraft separate to accommodate independent command queues onboard.~~ It receives and validates spacecraft software memory loads. It ensures that the uplinks are planned so that the onboard system can fulfill the activities specified in the ~~CFS~~ **detailed activity schedule**. It packages the ~~core-stored~~ **SCC-stored** command loads, spacecraft software memory loads, ~~core-stored~~ **SCC-stored** spacecraft table loads, and instrument microprocessor memory loads into spacecraft and instrument memory loads, a form ready to be received onboard. It must be capable of accommodating late changes for TOOs that impact previously generated loads. It makes available to the ICCs instrument command status and generates command load reports.

6.5.1.1.4 Commanding Service

The Commanding Service in the EOC will provide the capability to transmit **SCC-stored commands/tables, instrument commands/tables,** real-time commands and spacecraft and instrument **microprocessor** memory loads to the EOS spacecraft and instruments via EDOS. Delivery of the uplink data for the EOS spacecraft and instruments will be in accordance with the Consultative Committee for Space Data Systems (CCSDS) Telecommand standards. These uplink products are made available to the Commanding Service by either the EOC operators, the Command Management Service, or the ICCs. Each of these interfaces is discussed below.

The EOC operators will require that real-time spacecraft and instrument commands be constructed and uplinked in real time during contacts with the spacecraft and instruments. The Commanding Service performs the processing necessary for this function. In this category, commands are either entered directly by the operator or generated from a procedure or preplanned command group.

The Command Management Service prepares spacecraft and instrument **integrated** memory loads **containing SCC-stored spacecraft/instrument commands/tables, SCC software updates, and instrument loads** ~~and preplanned command groups~~ for uplink by the Commanding Service. The loads and command groups may contain both spacecraft or instrument commands and data, and are made available to the Command Management Service by the EOC operators and by the ICCs. The Commanding Service simply performs the processing necessary to successfully uplink the loads and groups to the spacecraft as requested by the EOC operators.

In the last category, the ICCs can have instrument commands uplinked to the instruments in real time by sending real-time command ~~groups~~ **requests** to the EOC. From the perspective of the EOC, these are unplanned command ~~groups~~ **requests** because they have not been preprocessed by the Command Management Service. Any preprocessing will have been performed by the ICC. For these groups, the Commanding Service will receive them directly from the ICCs, perform the necessary **generation and** validation, and transmit them to the spacecraft and instruments. The Commanding Service accepts command status information from EDOS and passes relevant information to the ICCs.

The Commanding Service also provides the capability to transmit messages to the NCC and EDOS.

6.5.1.1.5 Telemetry Processing Service

The Telemetry Processing Service will provide the capability to receive and process both real-time and ~~playback~~ **spacecraft recorder** telemetry **housekeeping** ~~engineering~~ data from the EOS spacecraft and instruments. This **housekeeping** ~~engineering~~ data will be downlinked from the spacecraft and instruments in Consultative Committee for Space Data Systems (CCSDS) packets. EDOS will transfer the packets to the EOC. For any ~~playback~~ **spacecraft recorder** data that are downlinked in reverse order, EDOS will provide the appropriate data reversal before transfer to the EOC. EOS telemetry data will thus arrive at the EOC in forward order.

When receiving real-time telemetry, the Telemetry Processing Service will decommutate the contents of the packets, performing the necessary conversions and calibrations and determining values for other derived parameters. Various forms of limit checking will be performed on the telemetry parameters, including boundary limit checking on non-discrete parameters, delta limit checking (examining the difference between successive parameter samples), and rail limit checking (checking for saturated, i.e., all one's, parameter values). For each parameter being checked for boundary limits, the Telemetry Processing Service will use one of several limit sets, in which each limit set consists of definitions for one or more upper and lower boundaries for the parameter. (These are commonly referred to as red/yellow, high/low limit sets.) All parameters, along with associated limits, quality, and event information will be made available to the operator through the User Interface Service. The Telemetry Processing Service will also extract a subset of the real-time telemetry stream for transfer to the FDF.

The Telemetry Processing Service will also receive and process ~~playback~~ **spacecraft recorder** telemetry data as needed. This process will primarily provide support for the in-depth analysis of the spacecraft subsystems.

6.5.1.1.6 Spacecraft Analysis Service

The spacecraft analysis functions provide the EOC operators with the capabilities needed to perform spacecraft systems management, performance analysis, trend analysis, configuration management, and resource management. These functions will be provided on a noninterference basis with real-time telemetry processing functions. A subset of these functions will be provided in real time. The spacecraft analysis service will also support fault detection and isolation.

The EOC ~~shall~~ evaluates the performance of the spacecraft core systems and the status of instruments. Instrument status will be provided by ICCs. Performance data will be processed from playback data, history files, and real-time data. The EOC will report on the quality of the data used for the analysis, report failures detected, and identify marginal system operation. Performance can be evaluated for a specified time interval and data can be evaluated for individual spacecraft core systems. The EOC will enable operators to analyze the performance of the power, command and data handling, thermal, communications, and guidance navigation and control subsystems.

The EOC ~~shall~~ performs both short term (7 day) trend analysis in support of operations and longer term sustaining engineering evaluation of the spacecraft, enabling the operators to evaluate specific parameters over time to determine performance of the spacecraft systems.

The EOC ~~shall~~ performs configuration management, enabling operators to determine and control the state of all spacecraft core systems and also to change the spacecraft configurations to correct for component failures, anomalies, or to satisfy operational requirements.

The EOC ~~shall~~ manages spacecraft resources, enabling operators to monitor propellant, energy balance, power levels, battery temperature, state of battery charge, and thermal load balance.

6.5.1.1.7 Data Management Service

The EOC Data Management Service generates and maintains a ~~project~~ **Spacecraft** Data Base ~~(PDB)~~ **(SDB)** and a history log. The ~~PDB~~ **SDB** contains descriptions of all spacecraft housekeeping data formats, housekeeping parameter descriptions, command formats, display formats, and operator directives needed to evaluate the health and safety of the spacecraft and instruments. The history log is used for maintaining the records of all spacecraft and instrument operations activities. It includes commands sent to the spacecraft and instruments, telemetry data received, NCC messages sent and received, operator directives, element manager directives, and event and alarm messages.

6.5.1.1.8 Element Management Service

The EOC Element Management Service will have capabilities to schedule EOC activities, manage the configuration of the EOC hardware and software, control and monitor the configuration of its components, monitor performance, manage operator and remote system access information, generate reports, and provide operations testing. It will coordinate operations with EDOS and the SMC.

The Local System Management tools will be used to provide appropriate EOC element management functions except where there are overriding operational considerations.

6.5.1.1.9 User Interface Service

The User Interface Service in the EOC will provide authorized EOC personnel with access to every function, including planning and scheduling, control and monitoring, and analysis and management of the spacecraft, instruments, and the EOC itself. This User Interface Service will consist of two main capabilities: a set of mechanisms through which the operator can specify actions to be taken by the system and provide responses and input, and a display function through which the user can monitor the spacecraft, instruments, the EOC components, and the results of user requests. The user interface will include a high-level interactive control language. The control language will provide the operator with the ability to input requests in a variety of forms (e.g., directives, procedures, **and pointing devices** ~~graphics~~). As a collection of related directives, user interface language procedures allow the user to automate the execution of functions that require multiple directives. Within the user interface language procedures, the language also provides other features such as nesting, conditional constructs, and timed execution.

The display portion of the User Interface Service primarily involves the display of information to the user in the form of text and graphical displays.

6.5.1.2 Conceptual EOC Architecture

The EOC is the element of the FOS, which is the control center for the EOS spacecraft and coordinates EOS mission operations. It receives DAR inputs via the **IMS** ~~SDPS~~ and returns status and acquisition planning and scheduling information. It exchanges planning and scheduling information with the ICCs, NCC, and FDF. Its final schedules are free from resource contention. It prepares real-time and stored commands for uplink via EDOS. It receives and processes spacecraft and instrument housekeeping telemetry packets from EDOS and high-level status information from the ICCs.

The following sections describe the EOC's interfaces and data flows.

6.5.1.2.1 EOC Interfaces

The Conceptual EOC Context Diagram is shown in Figure ~~6.5.1.2.1-1~~ **6-2**. The EOC's interfaces with other EOSDIS elements and external entities are described below.

6.5.1.2.1.1 EOC/ICC Interfaces

~~The EOC interfaces with the ICCs, coordinating the process that leads to the acquisition of new data by EOS instruments. The EOC forwards DARs to the appropriate ICC and receives status after the ICC analysis of the DAR.~~ In its role as mission coordinator, the EOC exchanges instrument planning and scheduling information with the ICCs, complying with the global access to planning and scheduling information concept. Some of this information will reflect late changes for faults and TOOs.

In response to the scheduling process, the ICCs generate instrument uplink data consisting of ~~core~~ **SCC**-stored commands, ~~core~~ **SCC**-stored tables, and instrument microprocessor loads, if applicable, which implement the scheduled observations. The EOC accepts instrument uplink data from the ICCs, validates them at a high level and integrates them. The instrument team will be responsible for the contents of its instrument microprocessor loads. In its role as overseer of mission operations, the EOC receives instrument status information from the ICCs in order to perform high-level monitoring.

6.5.1.2.1.2 EOC/SMC Interfaces

The EOC interfaces with the SMC, which is responsible for the overall management of the ground system resources used to perform the EOS mission. It receives EOS management and operations directives, including science policy and guidelines from the IWG plan, contained in the LTSP and LTIP, via the SMC. The EOC returns EOC management and operations status.

6.5.1.2.1.3 EOC/IMS Interfaces

~~The EOC interfaces with the IMS primarily in terms of user requests for the acquisition of new data. The IMS transfers DARs or updates to the EOC for further processing and analysis. The IMS can request status of a DAR that the EOC returns.~~ The EOC sends copies of acquisition plans and schedules to the IMS during its planning and scheduling activities to provide the user with information. The EOC provides the IMS with-spacecraft information, including orbit data, used in DAR generation.

6.5.1.2.1.4 EOC/DADS Interfaces

The EOC will provide the DADS with spacecraft status information and historical data about EOS mission operations for archiving. The EOC will receive from the DADS storage status which indicates the success or failure of storage of the data sent to DADS by the EOC.

6.5.1.2.1.5 EOC/IP ICC Interfaces

IP ICC assumption is stated in Section 6.1. The EOC exchanges planning and scheduling information with the IP ICC, sends mission status to the IP ICC, and receives instrument commands and status from the IP ICC, as in the case of the U.S. ICC.

6.5.1.2.1.6 EOC/EDOS Interfaces

The EOC provides spacecraft and instrument uplink data to EDOS. EDOS provides CCSDS packets containing real-time or ~~playback~~ spacecraft **recorded** and instrument housekeeping data, spacecraft and instrument command status data, and spacecraft processor memory dump data to the EOC. The EOC and EDOS exchange accounting, fault coordination, data operations status, and planning information. The EOC interfaces with EDOS to request changes in data delivery services and to make inquiries into data delivery status. EDOS provides the EOC with the data delivery service status.

6.5.1.2.1.7 EOC/NCC Interfaces

The EOC receives from the NCC forecast and active schedules of TDRSS contacts. The EOC transmits schedule requests for TDRSS with start times and duration to the NCC. The EOC and the NCC will exchange messages that include status and resource reconfiguration information.

6.5.1.2.1.8 EOC/FDF Interfaces

The EOC receives from the FDF predicted orbit data, including predicted ground track for scheduling. The EOC receives from the FDF contact scheduling data including UAV data and PSATs. The FDF will develop plans for corrective firings for orbit **maneuvers** ~~adjusts~~ in conjunction with the EOC. The EOC will receive, schedule, and implement these plans. The EOC will provide attitude sensor data to the FDF for determining spacecraft attitude.

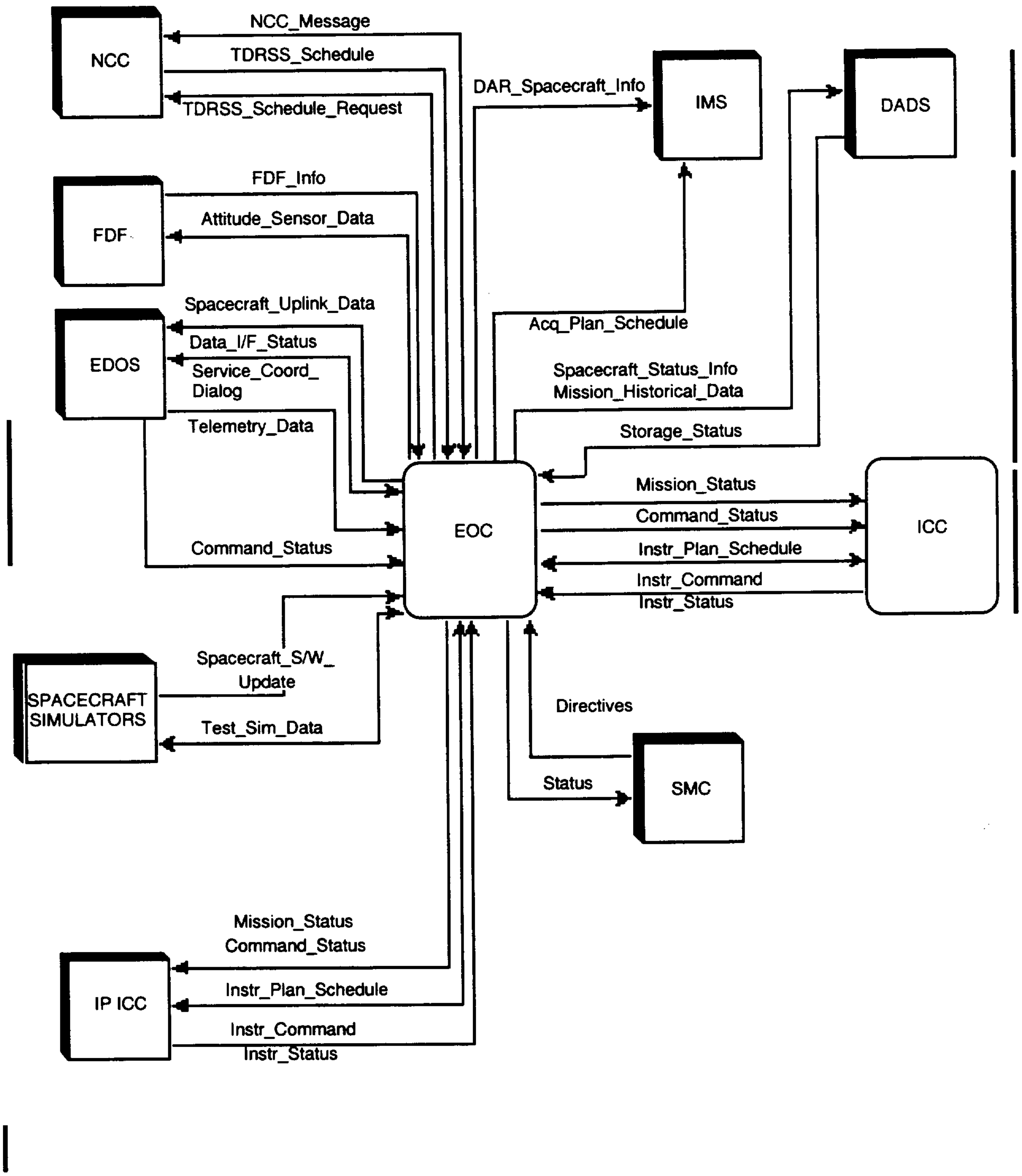


Figure 6-2. Conceptual EOC Context Diagram

6.5.1.2.1.9 EOC/Spacecraft Simulator Interfaces

The EOC receives flight software updates for uplink to the spacecraft from the spacecraft simulator. For training and simulations, the EOC will send spacecraft and instrument commands and simulator directives to the spacecraft simulator. The spacecraft simulators will send telemetry data and simulator responses to the EOC.

6.5.1.2.2 Data Flows

Table ~~6.5.1.2.2-1~~ **6-1** describes the general input, output, and process data flows that support the EOC services and functions.

Table 6-1. Conceptual EOC Data Flows (Page 1 of 2)

From	To	Data Item	Description
EOC	ICC	Instr_Plan_Schedule	Information on spacecraft resource availability, coordinated observation plans, spacecraft plans, guideline and priority updates, authorized instrument schedules.
		Mission_Status	Mission status information, including spacecraft status and contingency action information.
		Command_Status	Command uplink status, including when commands will be or were uplinked.
ICC	EOC	Instr_Plan_Schedule	Instrument resource needs and plans, instrument activity list, and instrument activity deviation list.
		Instr_Command	Command and other data to be forwarded to EDOS for uplink and then to be distributed to the instrument in real time, or delayed onboard. Includes real-time commands, stored commands, stored tables, instrument microprocessor load, and contingency data.
		Instr_Status	High-level instrument status information obtained from instrument telemetry, including identification of anomalous events.
EOC	SMC	Status	EOC management and operations status.
SMC	EOC	Directives	EOC management and operations directives, including science policy and guidelines from the IWG plan in the LTSP and LTIP.
EOC	IMS	DAR_Spacecraft_Info	Spacecraft, including orbit information used in DAR generation.
		Acq_Plan_Schedule	Instrument operations plans and schedules for user information.
EOC	DADS	Spacecraft_Status_Info	High-level information about the status of a spacecraft.
		Mission_Historical_Data	Information regarding EOS mission operations, including mission operations history.
DADS	EOC	Storage_Status	Information indicating success or failure of storage for data sent to DADS by the EOC.
IP ICC	EOC	Inst_Plan_Schedule	Instrument resource needs and plans, and schedules.

Table 6-1. Conceptual EOC Data Flows (Page 2 of 2)

From	To	Data Item	Description
		Instr_Command	Command to be forwarded to EDOS for uplink to be distributed to the instrument in real time or delayed onboard.
IP ICC	EOC	Instr_Status	High-level instrument information.
EOC	IP ICC	Instr_Plan_Schedule	Instrument resource needs and plans and schedules.
		Mission_Status	Mission Status information, including spacecraft status and contingency action information
		Command_Status	Command uplink status, including when commands will be or were uplinked
EOC	EDOS	Spacecraft_Uplink_Data	Forward-link data, including command transfer frames to be uplinked to the spacecraft and instruments.
		Data_I/F_Status	EOC coordination with EDOS, including accounting, fault coordination, data operations status, and planning.
		Service_Coord_Dialog	Requests for changes in data delivery services or inquiries into status, etc.
EDOS	EOC	Telemetry_Data	Return-link data in CCSDS packets, including spacecraft housekeeping data, SCC dumps, etc.
		Data_I/F_Status	EOC coordination with EDOS, including accounting, fault coordination, status, and planning.
		Command_Status	Spacecraft & instrument command transmission status.
		Service_Coord_Dialog	Responses to request for data delivery services/status.
EOC	NCC	TDRSS_Schedule_ Requests	Requests for TDRSS contacts.
		NCC_Message	Reconfiguration messages.
NCC	EOC	TDRSS_Schedule	Forecast and active TDRSS schedule and other scheduling information.
		NCC_Message	Status and reconfiguration messages.
FDF	EOC	FDF_Info	Predicted_Orbit_Data, Contact_Scheduling_Data, and Orbit_Adjust_D
		Predicted_Orbit_Data	Predicted orbit data, including predicted ground track information for scheduling
		Contact_Scheduling_ Data	Data used for scheduling contacts including User Antenna View (UAV) data and Predicted Site Acquisition Tables (PSATs).
		Orbit_Adjust_Data	Corrective firing plans for orbit adjusts developed by the FDF in cooperation with the EOC.
EOC	FDF	Attitude_Sensor_Data	Spacecraft sensor data for attitude determination and control (e.g., Sun sensor and star tracker).
EOC	S/C Sim-ulators	Test_Sim_Data	Command directives to control the simulator.
S/C Sim-ulators	EOC	Spacecraft_S/W_ Updates	Updates to flight software to be uplinked to the spacecraft.
		Test_Sim_Data	Telemetry data and simulator responses.

6.5.1.3 Functional Requirements

It is assumed that an IP's ICC responsible for controlling an IP instrument on the U.S. spacecraft is functionally equivalent to a U.S. ICC responsible for controlling a U.S. instrument on a U.S. spacecraft, and that it interfaces with the EOC in the same manner that a U.S. ICC responsible for a U.S. instrument on the U.S. spacecraft does with the EOC.

EOC-0005 **The EOC shall interface with the following external elements per the requirements specified in the referenced Interface Requirements Documents:**

- **a. NCC, per the ECS to NCC IRD**
- **b. FDF, per the ECS to FDF IRD**
- **c. ASTER ICS, per the ECS to ASTER IRD**
- **d. EDOS, per the ECS to EDOS IRD**
- **e. Platform and Instruments Command and Telemetry Databases, per the ECS to Spacecraft and Instruments Command and Telemetry Databases IRD.**
- **f. Spacecraft Simulator, per the ECS to Spacecraft Simulator IRD.**

EOC-0020 The EOC shall coordinate the operations of the instruments specified in Table D-1, Instrument Manifest.

EOC-0030 The EOC shall receive the LTSP and LTIP from the SMC.

EOC-0040 The EOC shall interface with EDOS for coordinating EDOS-provided services **required by the EOC** ~~(e.g., data delivery service messages, status)~~.

~~6.5.1.3.1 DAR Processing Service~~

EOC-1005 The EOC shall provide the IMS with spacecraft information, including at a minimum orbit information, for use in DAR generation.

~~EOC-1010 The EOC shall receive DARs and their updates from the IMS.~~

DELETED -- Subsumed by ICC-1050.

~~EOC-1020 The EOC shall be capable of processing DARs that require coordinated observations by two or more instruments.~~

DELETED -- Subsumed by ICC-1060.

~~EOC-1030 The EOC shall be capable of processing a DAR that requires coordination with observations of instruments on other EOS spacecraft and instruments.~~

DELETED -- Subsumed by ICC-1060.

~~EOC-1040 The EOC shall be capable of processing a DAR that specifies preferred observations with alternatives in priority order.~~

DELETED -- Subsumed by ICC-1070.

~~EOC-1050 The EOC shall accept a DAR, not related to a TOO observation, which requires the use of instruments on the EOS spacecraft, up to 28 days before the time of the observation.~~

MOVED -- Moved to ICC-1042.

~~EOC-1051 The EOC shall be able to accept a DAR or a DAR modification, not related to a TOO observation, which requires the use of instruments on the EOS spacecraft, between 28 and 7 days before the observation, although such a DAR will be subject to availability of resources left unallocated by the planning and scheduling process that begins 28 days before the observation.~~

MOVED -- Moved to ICC-1044.

~~EOC-1060 The EOC shall accept a DAR for a TOO observation up to 6 hours before the actual observation.~~

MOVED -- Moved to ICC-1115.

~~EOC-1070 In support of a TOO observation, the EOC shall be able to process the corresponding DAR from the IMS within 15 minutes.~~

MOVED -- Moved to ICC-1130.

~~EOC-1080 The EOC shall assign a priority to each DAR, based on a conformity check against the LTSP.~~

MOVED -- Moved to ICC-1082.

~~EOC-1110 The EOC shall provide each DAR to the appropriate ICC or ICCs to determine the technical feasibility of the DAR.~~

DELETED -- Subsumed by ICC-1050 and ICC-1080.

~~EOC-1120 The EOC shall accept from the ICC either DAR acceptance notification with updates, if any, or DAR rejection notification along with the reasons for rejection.~~

DELETED -- Subsumed by ICC-1160.

~~EOC-1130 The EOC shall accept from the ICC notification of DAR changes whenever a change occurs.~~

DELETED -- Subsumed by ICC-1160.

~~EOC-1140 The EOC shall maintain the status of all DARs.~~

MOVED -- Moved to ICC-1041.

~~EOC-1150 The EOC shall provide the IMS with DAR status upon initial determination of acceptance or rejection, upon request from the IMS, or upon change to the DAR or DAR status.~~

DELETED -- Subsumed by ICC-1160.

~~EOC-1160 The EOC shall be capable of processing DARs that request direct downlink service.~~

MOVED -- Moved to EOC-2005.

6.5.1.3.2 Planning and Scheduling Service

EOC-2005 The EOC shall be capable of processing ~~DARs that~~ **a** request **for** direct downlink service.

MOVED -- Moved from EOC-1160.

EOC-2010 The EOC shall accept from the FDF planning and scheduling information for the EOS spacecraft and instruments, which includes, at a minimum, the following:

a. Predicted orbit data **and associated uncertainties** including predicted ground track

b. EOS spacecraft and instrument ~~antenna view~~ **UAV** data

c. PSATs

d. Orbit ~~adjust~~ **maneuver** information

EOC-2030 The EOC shall store and maintain EOS planning and scheduling information, which includes, at a minimum, the following:

a. IWG science guidelines, as specified in the LTSP and LTIP

b. Long-term spacecraft operations plan

c~~b~~. Predicted availability of the spacecraft ~~core~~ resources

d. Baseline activity profile for each applicable instrument

e~~c~~. Planning and scheduling information received from the FDF

~~d. TDRSS schedules for the EOS spacecraft~~

f~~e~~. ~~STOPs~~ **Preliminary resource schedules, including TDRSS contact times**

~~f. SCARs accepted after the STOP has been generated~~

g. ~~CFSs~~ **Detailed activity schedules, including TDRSS contact times**

~~h. Spacecraft and instrument resource requirements~~

EOC-2040 The EOC shall provide to any authorized users (including the ICCs) read-only access to EOS planning and scheduling information.

EOC-2045 The EOC shall provide to any authorized users (including the ICCs) ~~a set of common tools~~ **a common set of capabilities** for formulating requests and for visualizing EOS planning and scheduling information ~~at the EOC~~.

EOC-2070 The EOC shall provide the capability to generate a ~~SCAR based on~~ spacecraft ~~subsystem maintenance needs~~ **subsystem resource profile, based, at a minimum, on the following:**

a. Spacecraft orbit maintenance needs

b. **Spacecraft navigation needs**

c. **Spacecraft subsystem maintenance needs**

~~EOC-2080 The SCARs generated at the EOC shall include at a minimum the following:~~

~~a. SCAR identifier~~

~~b. Core subsystem identifier~~

~~c. Time windows during which the core activity may be performed, and duration of the activity~~

~~d. Sequencing requirements with other core activities~~

~~e. Spacecraft resource requirements for the activity~~

~~f. Textual description of the activity~~

DELETED -- Subsumed by EOC-2070, with detailed information to be covered in the level-IV requirements.

~~EOC-2150 The EOC shall notify the IMS of the planned or scheduled observation times associated with each DAR and any subsequent changes to the times.~~

MOVED -- Moved to ICC-2055 (now the function of the ICC).

EOC-2160 The EOC shall provide plans and schedules to the IMS.

EOC-2170 The EOC shall be capable of planning and scheduling observations for which time may be specified in fixed or variable terms (~~e.g.~~ **i.e.**, to occur at a specific time, within a time window, or relative to the occurrence of a specified event). \\~~944~~,1098,637,~~1327~~\\

EOC-2180 The EOC shall be capable of planning and scheduling observations for those EOS instruments whose operations may be periodic, intermittent, or continuous.

EOC-2190 The EOC shall be capable of planning and scheduling coordinated observations involving **multiple** instruments. ~~on the U.S. spacecraft with the following:~~

~~a. Other instruments on the U.S. spacecraft~~

~~b. Instruments on other EOS spacecraft~~

EOC-2200 The EOC shall plan and schedule the management of spacecraft ~~core~~ resources that include, at a minimum, ~~tape recorders and communications subsystems.~~ **the following:**

a. **Spacecraft recorder**

b. **Communications subsystems**

c. **Thermal and power subsystems**

EOC-2205 The EOC shall adjust the amount of unallocated resources based on the ICC provided expected resource usage.

MOVED -- Moved from EOC-3026.

EOC-2210 The EOC shall have the capability to generate plans and schedules in both human readable and machine usable forms.

EOC-2220 The EOC shall identify and resolve conflicts based on, at a minimum, the following:

a. Resources needed for each observation or instrument support activity

b. Resources needed for each spacecraft core activity, if applicable

c. Inter-instrument dependency

d. In situ observation dependency

e. Priorities set by the LTSP

EOC-2230 If conflicts cannot be resolved in EOS planning and scheduling, the EOC shall make a choice between competing activities based on negotiations with and between the ICCs or on a decision by the Project Scientist or his designee. \\632\\

EOC-2240 The EOC shall reintroduce applicable requested activities in its planning and scheduling function when the activity did not occur due to a deviation from the schedule.

EOC-2250 The EOC shall be capable of performing its planning and scheduling function in ~~comprehensive~~ **batch** and incremental **interactive-user** modes.

EOC-2260 The EOC shall provide **"what-if" capabilities for planning and scheduling analysis, and provide them to authorized users, including** ~~the capability for~~ the ICCs. ~~-to access the EOC planning and scheduling function for "what-if" analysis~~..

~~6.5.1.3.2.1 Planning~~

EOC-2270 The EOC shall accept ~~a STIP and any updates~~ **an instrument resource profile or instrument resource deviation list (when a resource profile exists for the instrument)** from each ICC.

EOC-2272 For the instruments that have resource deviations lists, the EOC shall build instrument resource profiles by combining the resource deviation lists with the respective baseline resource profiles.

EOC-2280 At least once each week, the EOC shall generate **for each** ~~a STOP for the U.S.~~ spacecraft **a preliminary resource schedule** that describes all operations currently planned for the following ~~28-day period, starting the next~~ week.

EOC-2290 **Whenever the ICC's instrument resource profile cannot be integrated into a preliminary resource schedule, the** ~~The~~ EOC shall ~~notify the ICC of any activities in the STIP that cannot be integrated into a STOP~~ **provide the ICC with a notification that includes, at a minimum, an identification of the conflicting activities and the source of conflict.**

EOC-2300 The EOC shall build or update the ~~STOP~~ **preliminary resource schedule based on**~~, using as a basis at a minimum,~~ the following, **at a minimum**:

a. Existing ~~STOPs~~ **preliminary resource schedules**, if any

b. ~~Individual STIPs or their updates~~ **Instrument resource profiles**

c. Spacecraft subsystems resource profile

d~~c~~. Science guidelines

e~~d~~. ~~SCARs, if applicable~~ **Spacecraft operations constraints**

f. TDRSS schedule

EOC-2310 The EOC shall build a ~~STOP~~ **preliminary resource schedule** by performing the following:

a. Integrating ~~SCARs (if applicable) and individual STIPs or updates~~ **the spacecraft subsystems resource profile and individual instrument resource profiles**

b. Determining if required resources, **including SN resources,** are within limits

c. Using guidelines established by the LTSP

d. Resolving conflicts between the proposed activities

EOC-2320 The ~~STOP~~ **preliminary resource schedule** shall include, at a minimum, the following:

a. Activity or DAR identifiers

b. Resource availability and usage requirements

c. Time constraints and alternatives for planned activities

d. ~~Coordination requirements~~ **TDRSS schedule**

EOC-2350 The EOC shall provide the ~~STOP~~ **preliminary resource schedule** to the ICCs upon generation.

EOC-2370 The EOC shall generate TDRSS schedule requests based on the ~~needs identified in the STOP~~ **data rate profiles of all the instruments and spacecraft subsystems.**

EOC-2400 The EOC shall submit the TDRSS schedule requests to the NCC.

EOC-2405 The EOC shall accept the forecast TDRSS schedule from the NCC.

EOC-2410 The EOC shall accept from the NCC notification of rejection along with the reason for rejection, when all or a portion of the TDRSS schedule request cannot be accommodated.

EOC-2420 In response to the rejection of a TDRSS schedule request, the EOC shall have the capability to modify the request for resubmission to the NCC.

EOC-2430 The EOC shall, in 95 percent of all cases, generate a ~~STOP~~ **preliminary resource schedule** for ~~the~~ **one** spacecraft ~~in less than 2 hours~~ **within 2 hours after all required inputs are available.**

~~6.5.1.3.2.2 Scheduling~~

EOC-2460 The EOC shall be capable of generating or updating a ~~core activity specification~~ **spacecraft subsystem activity list** based on at a minimum the following:

a. Existing ~~CFS~~ **detailed activity schedule**

b. ~~STOP~~ **Preliminary resource schedule**

c. ~~SCARs accepted after the STOP has been generated~~ **Spacecraft subsystem activities identified after the preliminary resource schedule has been generated**

d. Current predicted orbit data and related information

e. Responses to emergency/contingency situations

~~EOC-2470 The core activity specification shall include at a minimum the following:~~

~~a. A list of core activities for spacecraft core subsystem maintenance (e.g., attitude sensor calibration)~~

~~b. A list of activities necessary for spacecraft orbit adjust, if applicable~~

~~c. Start time constraints and duration for each activity~~

~~d. Spacecraft resource requirements for each core activity~~

~~e. Sequencing requirements among the core activities~~

~~f. Impact of executing each activity on the spacecraft and instrument environment (e.g., vibration due to orbit adjust)~~

DELETED -- Subsumed by EOC-2460, information to be covered in level-IV requirements.

EOC-2480 The EOC shall accept ~~IASs and updates~~ from each ICC **an instrument activity list or an instrument activity deviation list (when an activity profile exists for the instrument) and any updates thereto.**

EOC-2482 **For the instruments that have instrument activity deviation lists, the EOC shall build the instrument activity lists by combining the instrument activity deviation lists with the respective baseline activity profiles.**

EOC-2490 ~~At least once each day, the~~ **The** EOC shall be capable of generating or updating **once each day** a ~~CFS~~ **detailed activity schedule** for ~~the~~ **each** spacecraft **and its instruments, nominally** covering the next 7 days.

EOC-2510 The EOC shall generate a ~~CFS~~ **detailed activity schedule** for the ~~U.S.~~ spacecraft **and its instruments** by:

a. Integrating the ~~core activity specification and individual IASs~~ **spacecraft subsystem activity list and individual instrument activity lists**

b. Determining if the aggregate resource requirements are within limits

c. Identifying and resolving conflicts among the proposed activities

d. Ensuring that all the sequencing constraints among the proposed activities are respected

e. Scheduling ~~tape~~ **the spacecraft** recorder~~, direct downlink,~~ and ~~other~~ communication subsystem operations

EOC-2520 If additional TDRSS schedule needs are identified while generating or updating a ~~CFS~~ **detailed activity schedule** ~~for the EOS spacecraft and instruments~~, the EOC shall make a request to the NCC for additional TDRSS services.

EOC-2530 If the request to the NCC for additional SN services is denied, the EOC shall regenerate or modify a ~~CFS~~ **detailed activity schedule** ~~for the EOS spacecraft and instruments~~ to account for the TDRSS service availability constraints.

EOC-2535 The EOC shall be capable of scheduling the use of the DSN, GN, or Wallops tracking station, in the event of an emergency or contingency that prevents communication through the TDRSS.

EOC-2540 The EOC shall notify the ICC of any **instrument** activities ~~in the IAS~~ that cannot be integrated into a ~~CFS~~ **detailed activity schedule**.

EOC-2550 The ~~CFS~~ **detailed activity schedule** shall include, at a minimum, the following:

a. ~~Detailed specifications of all instrument activities or references to them~~ **Instrument activities**

b. ~~Detailed specifications of spacecraft core activities necessary to support each instrument activity~~ **Spacecraft activities necessary to support all instrument activities**

c. Detailed specifications of all spacecraft ~~core~~ activities necessary for the spacecraft subsystem maintenance

d. Spacecraft resource requirements for each activity

e. Traceability of ~~the~~ **instrument** activities to DARs, ~~coordinated observations, in situ observations, instrument support activities, and spacecraft core activities, if applicable~~

EOC-2555 The EOC shall ~~be capable of evaluating~~ **evaluate** the impact of a TOO observation, ~~a critical instrument support activity~~, or a change to a scheduled observation, on other previously scheduled activities.

EOC-2560 The EOC shall ~~be capable of modifying~~ **modify** the ~~CFS~~ **detailed activity schedule** within 24 hours of issuance of unscheduled commands to reconcile the ~~CFS~~ **detailed activity schedule** with the unscheduled commanding for historical purposes.

EOC-2570 In support of a TOO observation **or late change**, the EOC shall ~~be capable of updating~~ **update** the ~~CFS~~ **detailed activity schedule** within 1 hour after ~~the~~ receipt of the **update to the** corresponding ~~IAS update~~ **instrument activity list or the instrument activity deviation list (when an activity profile exists for the instrument)**, if the update does not affect existing ~~CFS~~ **detailed activity schedule** events or create new conflicts.

~~EOC-2580 In support of a critical instrument support activity, the EOC shall be capable of updating the CFS within 1 hour after the receipt of the corresponding IAS update, if the update does not affect existing CFS events or create new conflicts.~~

DELETED -- Subsumed by EOC-2570.

EOC-2590 In support of a TOO observation **or a late change**, the EOC shall ~~be capable of updating~~ **update** the ~~CFS~~ **detailed activity schedule** within 10 hours after the receipt of the **update of the** corresponding ~~IAS update~~ **instrument activity list (or instrument activity deviation list)**, if the update affects existing ~~CFS~~ **detailed activity schedule** events or creates new conflicts.

~~EOC-2600 In support of a critical instrument support activity, the EOC shall be capable of updating the CFS within 10 hours after the receipt of the corresponding IAS update, if the update affects existing CFS events or creates new conflicts.~~

DELETED -- Subsumed by EOC-2590.

EOC-2620 The EOC shall provide the ICC with the ~~CFS~~ **detailed activity schedule** and any updates upon generation.

EOC-2630 The EOC shall, in 95 percent of all cases, generate a ~~CFS~~ **detailed activity schedule** for the spacecraft ~~in less than 2 hours~~ **within 2 hours after all required inputs are available.**

6.5.1.3.3 Command Management Service

EOC-3015 The EOC shall accept ~~software memory loads from the spacecraft simulators~~ **SCC flight software updates from the spacecraft simulator**.

EOC-3017 The EOC shall accept from the FDF parameters necessary for spacecraft command data generation, including the following:

a. Navigational operations parameters

b. Orbit maneuver parameters

EOC-3020 The EOC shall ~~be capable of accepting~~ **accept** from the ICC instrument ~~microprocessor memory~~ loads, ~~core-stored~~ **SCC-stored** instrument commands, or ~~core-stored~~ **SCC-stored** instrument tables ~~and~~ **or** associated information that includes at a minimum the following:

a. Instrument identifier

b. Schedule identifier, if applicable

c. Identification of commands that could impact spacecraft or instrument safety (i.e., critical commands)

EOC-3024 The EOC shall **validate** ~~compare~~ the expected resource usage. ~~that is contained in the ICC supplied command information to the scheduled resource usage.~~

~~EOC-3026 The EOC shall adjust the amount of unallocated resources based on the ICC provided expected resource usage.~~

MOVED -- Moved to EOC-2205.

EOC-3030 The EOC shall authenticate the originator of command information from the ICCs.

EOC-3050 ~~The EOC shall be capable, at~~ **At** least once per day, ~~of generating~~ **the EOC shall generate** ~~core-stored~~ **SCC-stored** spacecraft commands and ~~core-stored~~ **SCC-stored** spacecraft tables based on the ~~CFS~~ **detailed activity schedule** ~~and using EOS spacecraft and instrument command information~~.

EOC-3070 The EOC shall ~~be capable of generating~~ **generate** ~~core-stored~~ **SCC-stored** spacecraft commands and ~~core-stored~~ **SCC-stored** spacecraft tables for 24 hours of ~~core~~ **spacecraft** operations in less than 1 hour.

EOC-3080 The EOC shall generate, validate, and store **preplanned spacecraft** ~~spacecraft preplanned command groups~~ **commands** for later use ~~(e.g.,~~ in emergency situations to protect the health and safety of the spacecraft~~)~~.

EOC-3085 When building a **SCC** ~~core~~-stored command load, the EOC shall **have the capability to** organize commands into multiple independently executing command queues, one for each instrument and one for the spacecraft core.

EOC-3086 The EOC shall generate a command-to-memory location map for ~~core-stored~~ **SCC-stored** command loads.

EOC-3090 As frequently as necessitated by the ~~CFS~~ **detailed activity schedule**, the EOC shall build a spacecraft and instrument memory load ~~for the U.S. spacecraft~~, which **includes** ~~contains at a minimum~~ **as many of** the following as needed:

a. ~~Core-stored command loads~~ **SCC-stored spacecraft and instrument commands**

b. ~~Core-stored table loads~~ **SCC-stored spacecraft and instrument tables**

c. Instrument ~~microprocessor memory~~ loads

d. ~~Spacecraft software memory loads~~ **SCC software updates**

EOC-3160 The EOC shall generate operational reports including, at a minimum, ~~a command load report~~ **the following**:

a. SCC-stored command load report

b. Integrated report having orbital events, command execution times, and TDRS contacts with candidate loads.

EOC-3200 The EOC shall accept from the ICC ~~instrument preplanned command groups~~ **preplanned instrument commands** for issuance by the EOC ~~in the event of an anomaly~~ **to ensure the health and safety of the spacecraft and all instruments**.

EOC-3210 The EOC shall store and maintain ~~instrument preplanned command groups~~ **preplanned instrument commands** for all instruments on the spacecraft.

EOC-3225 In support of a TOO observation **or late change**, the EOC shall prepare the corresponding ~~spacecraft and instrument memory loads~~ **integrated load and/**or **real- time** instrument command ~~sets~~ **set** within 15 minutes of receipt of the ~~core-stored~~ **SCC-stored** instrument ~~command loads~~ **commands,** ~~core-stored~~ **SCC-stored** instrument ~~table loads~~ **tables,** or instrument ~~microprocessor memory loads~~ **load** from the ICC, if the observation does not impact previously scheduled activities.

EOC-3226 In support of a TOO observation **or late change**, the EOC shall prepare the corresponding ~~spacecraft and instrument memory loads~~ **integrated load and/**or **real-time** instrument command ~~sets~~ **set** within 1 hour of receipt of the ~~core-stored~~ **SCC-stored** instrument ~~command loads~~ **commands**, ~~core-stored~~ **SCC-stored** instrument ~~table loads~~ **tables,** or instrument ~~microprocessor memory loads~~ **load** from the ICC, if the observation impacts previously scheduled activities.

~~EOC-3235 In support of a critical instrument support activity, the EOC shall prepare the corresponding spacecraft and instrument memory loads or instrument command sets within 15 minutes of receipt of the core-stored instrument command loads, core-stored instrument table loads, or instrument microprocessor memory loads from the ICC, if the activity does not impact previously scheduled activities.~~

DELETED -- Subsumed by EOC-3225.

~~EOC-3236 In support of a critical instrument support activity, the EOC shall prepare the corresponding spacecraft and instrument memory loads for instrument command sets within 1 hour of receipt of the core-stored instrument command loads, core-stored instrument table loads, or instrument microprocessor memory loads from the ICC, if the activity impacts previously scheduled activities.~~

DELETED -- Subsumed by EOC-3226.

EOC-3238 **Within 1 minute of detecting a predefined emergency/contingency situation,** ~~The~~ **the** EOC shall ~~have the capability to provide~~ **prepare** spacecraft and instrument commands **for transmission to EDOS** ~~within 1 minute of detecting a predefined emergency/contingency situation.~~

~~EOC-3240 The EOC shall be capable of producing spacecraft and instrument memory loads covering 24 hours of spacecraft operation in less than 1 hour.~~

DELETED -- Subsumed by EOC-3070.

6.5.1.3.4 Commanding Service

EOC-4005 The EOC shall be capable of transmitting commands to:

a. SN

b. GN, DSN, WTS (for contingency or emergency operations)

EOC-4008 The EOC shall be capable of transmitting commands via Ecom. **1540**\\\\

EOC-4010 **For each spacecraft and its instruments,** ~~The~~ **the** EOC shall ~~provide the spacecraft and instrument commands, in accordance with the CCSDS Telecommand Standard, to EDOS for uplink to the spacecraft and instruments.~~ **prepare command data sets that conform to the CCSDS Telecommand Standard.**

EOC-4015 The EOC shall provide the capability to build real-time commands based on operator input and validate the generated commands.

EOC-4017 The EOC shall receive from the ICC instrument real-time command groups destined for the EOS spacecraft and instruments.

EOC-4018 The EOC shall validate instrument real-time command groups.

EOC-4020 The EOC shall merge the real-time commands supplied by the spacecraft operator, command groups, and the spacecraft and instrument memory loads into one uplink stream.

EOC-4060 The EOC shall provide the capability to exchange messages with the NCC, which include at a minimum status and reconfiguration messages.

EOC-4100 The EOC shall provide the capability to control the uplink of critical commands by requiring a second positive response from the operator.

EOC-4120 The EOC shall provide the capability to verify via telemetry the successful receipt of all commands by the spacecraft and instruments.

EOC-4125 The EOC shall provide the capability to verify via telemetry the successful execution of spacecraft commands.

EOC-4130 The EOC shall provide the capability to receive and evaluate command transmission status information from EDOS.

EOC-4140 The EOC shall generate ~~appropriate~~ command-related event messages for display ~~to the operators~~ and for history logging **to include:**

a. Command uplink status

b. Command verification status

EOC-4160 The EOC shall maintain a record of the uplink status of all spacecraft and instrument memory loads and real-time commands.

EOC-4166 The EOC shall provide the ICC with instrument uplink status, which includes at a minimum the following:

a. Receipt at the EOC

b. Validation status

c. Receipt at the spacecraft and instrument

EOC-4168 The EOC shall provide the ~~appropriate~~ ICCs with instrument command notification messages, when emergency/contingency instrument commands are issued **to include:**

a. Instrument command uplink status

b. Instrument command verification status

EOC-4200 The EOC shall support several uplink rates to the spacecraft, which include at a minimum the following:

a. ~~K-band at 100~~ **10** kilobits per second (kbps) **(SSA uplink)**

b. ~~S-band at~~ 1 kbps **(SMA uplink)**

c. 125 bits per second (bps) ~~(for contingency operations)~~ **(SSA uplink during contingency operations)**

d. 2 kbps (emergency operations via S-band DSN link)

EOC-4210 The EOC shall ~~provide~~ **transmit to** EDOS ~~with~~ the corresponding uplink information within 500 milliseconds of receiving ~~the instrument real-time command group containing~~ a single **real-time** emergency command **request** from ~~the~~ **an** ICC.

6.5.1.3.5 Telemetry Processing Service

EOC-5010 The EOC shall receive from EDOS the following telemetry data types in CCSDS packets containing:

a. Real-time spacecraft and instrument housekeeping data

b. ~~Playback~~ **Spacecraft recorded** spacecraft and instrument housekeeping data

c. ~~Spacecraft processor~~ **SCC** memory dump data

EOC-5012 The EOC shall be capable of processing ~~playback~~ **spacecraft recorder** data for all periods of time during which real time data was not received.

EOC-5015 The EOC shall be capable of simultaneously receiving all **EOS** telemetry data types.

EOC-5020 The EOC shall ~~provide the capability to~~ receive and process **spacecraft** telemetry data ~~associated with the launch vehicle at~~ **during** spacecraft launch.

EOC-5030 The EOC shall provide the capability to receive and process, ~~as appropriate,~~ non-telemetry data, which includes at a minimum the following:

a. Messages from the NCC

b. Monitor blocks from the DSN, GN, and Wallops tracking station

c. Status messages from EDOS

EOC-5045 The EOC shall be capable of supporting all **EOS** telemetry formats for spacecraft and instrument housekeeping data.

EOC-5050 The EOC shall provide the capability to receive **and report** data quality information with the incoming CCSDS packets as provided by EDOS.

EOC-5070 The EOC shall provide the capability to detect **and report** gaps in the telemetry data it receives.

EOC-5080 The EOC shall provide the capability to decommutate spacecraft and instrument housekeeping data.

EOC-5090 The EOC shall perform the necessary engineering unit conversion, derived parameter generation, and digital and discrete state determination on the decommutated ~~engineering~~ **housekeeping** data.

EOC-5100 The EOC shall provide the capability to perform limit checking on all non discrete parameters within the real-time telemetry, flagging all parameters that have limit violations.

EOC-5105 The EOC shall support the definition of up to four sets of boundary limits for each non-discrete parameter, with each set including definitions for one or more upper and lower boundaries.

EOC-5110 The EOC shall provide the capability to generate an ~~appropriate~~ event message whenever a predetermined number of limit violations for a parameter is detected.

EOC-5120 The EOC shall provide the capability to accept temporary or permanent changes to limit definitions.

EOC-5130 The EOC shall ~~provide the capability to~~ determine the best estimate for ~~spacecraft~~ **SCC** memory contents using two or more dumps.

EOC-5180 The EOC shall provide the capability to extract specified subsets of the telemetry stream.

EOC-5185 The EOC shall provide the FDF with a subset of telemetry stream ~~(e.g., attitude sensor data)~~**, which includes the following:**

a. Attitude sensor data

b. Navigation telemetry data

c. **Orbit maneuver telemetry data**

EOC-5187 The EOC shall have the capability to determine the spacecraft clock time bias required for synchronizing the spacecraft clock relative to universal time coordinated (UTC).

EOC-5190 The EOC shall provide the capability to store ~~playback~~ **spacecraft recorder** telemetry data as they are received from EDOS in CCSDS packets.

EOC-5200 The EOC shall provide the capability to process stored telemetry data at an operator-selectable rate.

EOC-5220 The EOC shall be able to process real-time data at rates up to 50 kbps per spacecraft.

EOC-5230 The EOC shall be able to receive and record ~~playback~~ **spacecraft recorder** data at rates up to 1.544 Mbps.

EOC-5240 The EOC shall be able to process history and ~~playback~~ **archived spacecraft recorder** data at rates up to 150 kbps.

6.5.1.3.6 Spacecraft Analysis Service

EOC-6010 The EOC shall provide the capability to perform analysis on real-time data, **spacecraft recorder** ~~playback~~ data, and data from the EOC history log.

EOC-6020 The EOC shall accept instrument status data from each ICC.

EOC-6050 The EOC shall provide the capability to determine, for specified parameters over a specified time interval, at a minimum the following:

a. Minimum value

b. Maximum value

c. Mean value

d. Standard deviation of the parameter

e. Time and duration of limit violations

EOC-6060 The EOC shall provide the capability to plot a specified parameter against another parameter or against time.

EOC-6070 The EOC shall provide the capability to time-correlate related spacecraft parameters.

EOC-6080 The EOC shall provide the capability to define, check, and manage spacecraft operations procedures.

EOC-6100 The EOC shall provide the capability **to perform** ~~for~~ trend analysis ~~of~~ **on** spacecraft and instrument housekeeping parameters.

EOC-6110 The EOC shall provide the capability to monitor and evaluate the spacecraft functions, ~~capacities~~ **resources**, and performance, including at a minimum the following:

a. Stored command processing

b. ~~Tape~~ **Spacecraft** recorders

c. Safe mode processes

d. Electrical power subsystem

e. Propulsion subsystem

~~EOC-6120 The EOC shall provide spacecraft system modeling and performance assessments.~~

DELETED - Subsumed by EOC-6110.

EOC-6130 The EOC shall monitor the configuration of the spacecraft and instruments. ~~and shall recommend reconfigurations.~~

EOC-6135 The EOC shall have the capability to recommend spacecraft reconfigurations.

EOC-6140 The EOC shall provide the capability to maintain a record of the spacecraft and intrument configuration, including the state ~~(e.g., on, off, idle, failed)~~ of all spacecraft ~~systems~~ **subsystems** and instruments.

EOC-6150 The EOC shall provide the capability to maintain a master ground image of the **SCC** spacecraft memory.

EOC-6160 The EOC shall provide the capability to compare the master ground image and the ~~spacecraft~~ **SCC** memory dump.

EOC-6170 The EOC shall be capable of detecting failures and anomalies including at a minimum the following:

a. Ground system and space/ground communications faults

b. Spacecraft faults

c. Instrument faults that affect the spacecraft

~~EOC-6180 The EOC shall coordinate the isolation of faults with other elements and external systems.~~

DELETED -- Subsumed by EOC-8230, EOC-8240, and EOC-8250.

~~EOC-6190 The EOC shall resolve spacecraft failures and anomalies.~~

DELETED -- Subsumed by EOC-6195, EOC-6200, and EOC-6210.

EOC-6195 The EOC shall provide the capability to **detect, isolate, and report failures and anomalies** ~~perform fault management~~ at the **spacecraft subsystem** ~~flight system~~ level, the spacecraft level, and at the mission activity level.

EOC-6200 The EOC shall **detect, isolate, and report** ~~coordinate the resolution of~~ failures and anomalies involving the spacecraft and instruments, communications with the spacecraft, and ground operations support of the spacecraft.

EOC-6210 The EOC shall be capable of providing recommended courses of actions for selected contingency situations.

6.5.1.3.7 Data Management Service

6.5.1.3.7.1 EOC ~~Project~~ Spacecraft Data Base

EOC-7010 The EOS Spacecraft ~~and instrument~~ **Data Base** ~~PDB~~ **(SDB)** shall include at a minimum the following:

a. Housekeeping data formats

b. Housekeeping data parameter descriptions

c. Command descriptions

d. Syntactical rules for commands and operator directives

e. Operator directives

f. Display formats

g. Planning and scheduling definitions and constraints

h. Analysis algorithms

i. Report formats

j. NCC configuration codes

k. Derived telemetry parameter equations

l. Telemetry parameter limits

m. **Characteristics of** spacecraft and **its** instruments ~~characteristics~~

n. Command validation parameters

o. Operations procedures

EOC-7015 The EOC shall receive from the ICCs instrument-specific portion of the SDB and/or any updates thereto.

EOC-7020 The EOC shall maintain the latest two versions of the ~~PDB~~ **SDB.**

EOC-7025 The EOC shall provide the ~~tools~~ **capabilities** to generate and modify the ~~PDB~~ **SDB.**

EOC-7030 The EOC shall be capable of syntax and structure checking of the ~~PDB~~ **SDB.**

EOC-7040 The EOC shall provide accounting information on the contents of the ~~PDB~~ **SDB.**

EOC-7045 The EOC shall generate a report identifying any problems with the contents of the ~~PDB~~ **SDB.**

6.5.1.3.7.2 EOC History Log

EOC-7060 The EOC shall maintain a history log for the spacecraft and instruments for 7 days, including at a minimum the following:

a. All messages sent and received

b. Telemetry data

c. Operator requests/directives

d. Real-time commands

e. Stored command loads

f. Memory loads and dumps

g. Limits violations

h. Error conditions

i. Warnings

j. Alarms

k. Spacecraft and instrument status information

l. Executed schedules

m. Analysis results

n. Responses to operator requests

o. User interface language procedures as they were executed

p. EOC reconfiguration information

EOC-7110 The EOC shall provide the capability to send the complete history log or a subset of the data with associated metadata to a designated DADS.

EOC-7115 The EOC shall accept storage status, indicating the success or failure of the storage of the history data, from the DADS.

EOC-7116 The EOC shall maintain the history log until the DADS has notified the EOC of successful storage.

EOC-7120 The EOC shall be capable of extracting data sets from the history log by specifying time and data type **to include as a minimum:** ~~(e.g.,~~ telemetry, command, NCC messages, operator directives, events, or limits violations~~)~~.

EOC-7125 The EOC shall provide spacecraft status data to an ICC.

EOC-7130 The EOC shall be capable of maintaining a subset of history data in support of long term analysis.

EOC-7140 The EOC shall be capable of storing documentation on-line for operator support, including at a minimum the following:

a. Operator guides

b. Operational procedures

EOC-7150 The EOC shall ~~be the repository for~~ **store** the technical documentation of the spacecraft hardware and software from before launch through ~~disposal~~ **the end of spacecraft operation.**

EOC-7160 The EOC shall be capable of updating the spacecraft technical documentation.

6.5.1.3.8 Element Management Service

EOC-8005 The EOC element shall collect the management data used to support the following system management functions:

a. Fault management

b. Configuration management

c. Accounting management

d. Performance management

e. Security management

f. Scheduling management.

6.5.1.3.8.1 EOC Scheduling

EOC-8010 The EOC shall have the capability to schedule its ~~resources~~ **systems and communications interfaces** that are used for **multiple** spacecraft and instrument operations and for other activities, including maintenance, upgrade, sustaining engineering, testing, and training.

EOC-8020 The EOC shall ~~coordinate the scheduling~~ **maintain and provide a schedule** of interface and end-to-end tests with the external elements involved, including the ICCs, the spacecraft simulator(s), the SMC for other EOS elements, and EDOS for MO&DSD data delivery systems.

6.5.1.3.8.2 Operations Configuration Control

EOC-8090 The EOC shall establish its configuration**, including functional connectivity within the EOC and between the EOC and external interfaces,** for **multiple** spacecraft and instrument operations, tests, and maintenance ~~, according to the schedule, and including the functional connectivity within the EOC and between the EOC and external interfaces~~.

EOC-8100 The EOC shall perform **prepass** operational readiness tests on the EOC and between the EOC and external interfaces **(via test messages).**

EOC-8110 The EOC shall support reconfiguration to work around faults and anomalies without interrupting other ongoing operations.

EOC-8130 The EOC shall ~~request~~ **allow** operator ~~confirmation~~ **override** for reconfiguration requests that violate operational constraints.

EOC-8140 The EOC shall manage initialization and shutdown of EOC functions.

6.5.1.3.8.3 Performance Monitoring

EOC-8150 The EOC shall provide the capability to analyze **and report** its internal performance at a minimum for the following:

a. CPU utilization

b. ~~Data~~ **Processing** throughput for plans and schedules, ~~DARs,~~ and commands

c. Equipment downtime

d. Mass storage utilization

e. Communication resource utilization

f. Data accounting

EOC-8160 The EOC shall alert the operator when its status changes or when data errors exceed operator-specified levels.

6.5.1.3.8.4 Fault Management

EOC-8220 The EOC shall manage its faults including at a minimum the following:

a. Fault identification and reporting

b. Identification of recommended solutions

c. Log of fault activities through resolution

EOC-8230 The EOC shall analyze **and report** the configuration, status, accounting, and performance information received from EOC components.

EOC-8240 The EOC shall be capable of initiating diagnostics to aid in isolating internal faults, using safeguards to prevent their operations from affecting other operations.

EOC-8250 The EOC shall ~~participate in the resolution of~~ **identify and report** failures and anomalies involving the interfaces of the EOC.

6.5.1.3.8.5 Operations Testing

EOC-8260 The EOC shall provide tests for validating, verifying, and checking functional capabilities and performance for EOC functions after the EOC has been repaired or upgraded.

EOC-8270 The EOC shall provide standard test data sets to be used in the validation of EOC functions.

EOC-8285 The EOC shall ~~provide~~ support ~~to~~ instrument integration activities associated with the spacecraft **prior to launch**.

EOC-8290 The EOC shall use simulations and test functions of the spacecraft simulator(s) to check out the EOC functions.

EOC-8320 The EOC shall support spacecraft and instrument tests at the integration site and at the launch site.

EOC-8330 The EOC shall provide the capabilities:

a. To test both nominal operations and failure paths

b. To log test activities **and test configuration**

c. To support analysis of test data and the generation of test results

d. To maintain test procedures~~, test configuration,~~ and test results

6.5.1.3.8.6 Report Generation

EOC-8370 The EOC shall generate at a minimum the following:

a. Security audit log

b. EOC resource utilization report

c. EOC status report

d EOC hardware/software configuration history

EOC-8372 The EOC shall be capable of accessing ICC reports.

EOC-8375 The EOC status report shall include at a minimum the following:

~~a. DAR statistics~~

b. Compliance with the LTSP and LTIP

c. Anomaly reports

d. Maintenance report

e. ICC status report information

EOC-8380 The EOC shall provide the SMC with access to EOC reports, including at a minimum the following:

a. Plans and schedules

b. Security actions

c. Maintenance information

6.5.1.3.9 User Interface Service

EOC-9010 The EOC shall provide the capability for the operator to control the EOC functions and components, utilizing a combination of input devices. ~~and styles, as appropriate.~~

EOC-9020 The EOC shall provide the capability for the operator to ~~output spacecraft, instrument,~~ **send to displays, printers, and files spacecraft, instrument,** and ground system information used or generated by each EOC function~~, to displays, printers, and files~~.

EOC-9025 The EOC shall provide the capability to notify the operator of events and alarms.

EOC-9040 The EOC shall support the use of a high-level interactive control language, which consists of a set of directives and programming-like language capabilities, including at a minimum the following:

a. Evaluate algebraic and logical expressions

b. Exercise decision logic (IF statements)

c. Automated execution of a set of multiple directives (i.e., user interface language procedure)

d. Internally branch to other parts of the user interface language procedure

e. Nest user interface language procedures within procedures

f. Initiate other EOC applications

EOC-9080 The EOC shall provide the operator with the capability to create, modify, and delete user interface language procedures.

EOC-9090 The EOC shall provide the capability for the operator to define the format and contents of text and graphics displays.

EOC-9110 The EOC shall respond to operator inputs within 0.5 seconds.

EOC-9130 The EOC shall be capable of updating displays of rapidly changing information (~~e.g.,~~ **i.e.,** telemetry data) at rates of up to once per second.

6.5.1.4 EOC Performance

EOC-9510 The EOC shall ~~be capable of supporting~~ **support** the following simultaneous activities:

a. Performing mission coordination, planning, scheduling, monitoring, and commanding of the U.S. spacecraft and instruments **as listed in Table D-1**.

b. At least two of the following: mission test activities, EOC system upgrades, training, and/or maintenance.

EOC-9520 The EOC computer hardware shall be able to grow without redesign to twice the processing, storage, and communications capacities estimated for full system operation.

EOC-9570 The EOC computer processing, storage, and communications capacity utilization shall be less than 50 percent at turnover for operations.

EOC-9580 The EOC architecture shall be capable of growing to support additional spacecraft without major redesign.

EOC-9590 The EOC design shall include hooks to support additional spacecraft without major redesign.

6.5.2 Instrument Control Center (ICC)

6.5.2.1 Overview

The ICCs are responsible for the planning, scheduling, commanding, and monitoring of the U.S. instruments onboard the U.S. spacecraft. There is functionally one ICC for each U.S. instrument. IPs are expected to have functionally equivalent ICCs for IP instruments onboard the U.S. spacecraft.

The specifications for the ICC are meant to accommodate a wide variety of instruments. These specifications must be customized for each instrument. Not all instruments will require all services and some instruments will require unique services.

Operating in conjunction with ICCs are IST toolkits that interface with the ICCs via the ESN. An IST provides an instrument PI/TL or designee capabilities at their home facilities for viewing and interacting with an ICC for the respective instrument operations. IST capabilities are provided to U.S. investigators with instruments on the U.S. spacecraft. In the context of these requirements, the IST is treated as a subelement of the ICC.

The EOC interacts with an ICC to coordinate the planning and scheduling of instrument activities with respect to the overall activities of the spacecraft. The EOC also serves as the collection point from each ICC for the instrument commands required for the spacecraft.

The ICC receives engineering telemetry and selected quick-look science data from EDOS for the purposes of instrument monitoring. Both real-time and playback telemetry will be received by the ICC. For some instruments, engineering telemetry may be embedded in science data packets, in which case it is extracted from the science data packets by the ICC. Some processed quick-look science data will also be received from a DADS for monitoring.

The ICC ~~shall~~ **will** participate in integration and testing of its instrument before launch, provide initial checkout of the instrument soon after launch, and maintain 24 hour operations support for the life-time of the instrument.

The nine major services provided by each ICC consist of DAR processing, planning and scheduling, command management, commanding, telemetry processing, instrument analysis, instrument data management, element management, and user interface. Each of these services is described briefly below. More detailed requirements for these services are contained in Section 6.5.2.3.

6.5.2.1.1 DAR Processing Service

Authorized users at the ICC may generate and submit DARs to the IMS in **the** same manner as other authorized users would access the IMS DAR generation capabilities. An IMS toolkit at an ICC will be provided to aid in the construction of the DAR and account checking with SMC before the submission of the DAR and subsequent transmission to IMS (via the ESN). ~~The IMS will log the DAR and send it on to EOC for subsequent analysis.~~

DARs that are input into the ECS system will be sorted out according to applicable instruments by the ~~EOC~~ **IMS** and sent to the ICC for analysis. The ICC can communicate with the DAR originator for modification or clarification of the DAR. The ICC will subsequently provide analysis results to the ~~EOC~~ **IMS**. Support may be provided by the PI/TL via the IST.

6.5.2.1.2 Planning and Scheduling Service

The ICC will receive the LTIP and LTSP from the IWG via the SMC. These plans will serve as a basis for short-term instrument planning and scheduling activities at the ICC.

At least once per week, each ICC will ~~review~~ **generate** ~~and~~ **or** update, if necessary, ~~a STIP~~ **an instrument resource profile** for its instrument~~,~~ ~~to cover the next 28 days~~ **covering a target week** of operations. The ~~STIP~~ **instrument resource profile** is generated based on the LTIP, all DARs received to date, and ~~ISARs~~ **instrument support activities** (e.g., the plans for the instrument calibration and maintenance activities). Additional input (e.g., from science assessment) for generation of the ~~STIP~~ **instrument resource profile** may come from the IST. The ICC will send ~~the STIP~~ **its instrument resource profile** to the EOC where it will be integrated with the ~~STIPs~~ **instrument resource profiles from** ~~for~~ the other instruments on the spacecraft, resulting in the creation of a ~~28-day STOP for the spacecraft~~ **preliminary resource model**. For some instruments, the ICC may have to provide several updates of a ~~STIP~~ **instrument resource profile** to the EOC in order to resolve all planning conflicts before the EOC can build a conflict-free ~~STOP~~ **preliminary resource model**. Alternatively, the ~~STIP~~ **instrument resource profile** for many instruments may vary little from week-to-week, often requiring no update whatsoever.

At least once per day, the ICC will build or update, as needed, ~~a 7-day IAS for its instrument~~ **an instrument activity list that covers several days of operations**, in coordination with **the** EOC and based on the ~~STOP~~ **preliminary resource model**. The ICC will send the ~~IAS~~ **instrument activity list** to the EOC for integration into a ~~7-day CFS for the spacecraft~~ **detailed activity schedule, covering several days**. Depending on the instrument, the ICC may have to send several updates of its ~~IAS~~ **instrument activity list** to the EOC in order for the EOC to build ~~a CFS~~ **an acceptable detailed activity schedule** ~~for the whole spacecraft~~ or to respond to TOOs or other contingency/emergency situations. Most instruments, however, will normally have the same ~~IAS~~ **instrument activity list** day-to-day, or have small variations **that can be specified in an instrument activity deviation list.** The ICC also provides interactive scheduling capabilities to the PI/TL at the IST to aid in the decision making of the schedule generation.

TOOs or needs for critical instrument support activities can result in expedited updates of the ~~IAS~~ **instrument activity list** if ~~a~~ **the responding** ~~late-occurring~~ request ~~responding to the TOO or the critical instrument support activity need~~ is received within a short time of the requested activity.

6.5.2.1.3 Command Management Service

The Command Management Service provides the non-real-time generation of instrument commands and memory loads required for the operation of an instrument. It generates and assembles the commands, tables, and/or memory loads required for the operation of an instrument based on the approved ~~CFS~~ **detailed activity schedule**. It prepares, depending on the applicability to its instrument, ~~core-stored~~ **SCC-stored** instrument commands, ~~core-stored~~ **SCC-stored** instrument tables, instrument preplanned command groups, or instrument microprocessor memory loads, using command information it gets from the ICC instrument data base. ~~Core-stored~~ **SCC-stored** commands and tables and instrument preplanned command groups are described in Section 6.5.1.1.3. These must be managed by the EOC and the spacecraft after being generated by the ICC. Instrument microprocessor memory loads, on the other hand, are managed solely by the ICC and are treated as a pass-through package by the EOC and the spacecraft. Instrument microprocessor loads can contain a variety of data for the instrument, including microprocessor software, microprocessor-stored tables, or microprocessor-stored commands.

The Command Management Service generates and, on request, stores and maintains instrument command groups. These are sets of commands which are not stored on board the spacecraft for delayed execution, but, when issued from the ground, are executed immediately on board. Command groups can be stored at the ICC or at the EOC depending on their applicability. Command groups will be transmitted by the ICC Commanding Service to the EOC either for storage and later uplink on request, or for immediate uplink; from the perspective of the EOC, these are referred to as preplanned and real-time command groups, respectively. The Command Management service can also accept from the IST instrument microprocessor loads, if applicable, when they are generated by the PI/TL.

6.5.2.1.4 Commanding Service

While the Command Management Service provides the off-line preparation of ~~scheduled and preplanned instrument command and microprocessor loads and command groups~~ **integrated loads**, the Commanding Service provides for their transfer to the EOC. The ICC also provides the capability to generate and validate instrument command ~~groups~~ **group requests** as they are needed in emergency/contingency situations. These groups are generated either in response to an instrument command request received from the IST or upon detecting an emergency/contingency situation for an instrument. In both cases, these groups are provided to the EOC for immediate **generation, validation and uplink** (subject to spacecraft contact) ~~uplink~~ to the instrument.

Note that the instrument command groups referred to throughout the ICC commanding service section (and also in the Command Management Service) are the same as those discussed in the EOC sections. They are collections of one or more real-time instrument commands that can be generated and validated at the ICC in a preplanned manner. They are either stored at the ICC or EOC as appropriate, for later use; or uplinked immediately.

The ICC tracks the status of all commands issued from the ICC.

6.5.2.1.5 Telemetry Processing Service

The ICC provides health and safety monitoring for its instrument. It receives real-time or ~~playback~~ **spacecraft recorder** spacecraft and instrument housekeeping data and instrument engineering data in CCSDS packets directly from EDOS. For some instruments, instrument engineering data received from EDOS may be embedded in science packets, from which the ICC will have to extract the instrument engineering data. The ICC extracts the relevant spacecraft parameters and instrument housekeeping data from the spacecraft and instrument housekeeping data stream. The ICC uses these data for both short-term instrument health, safety, and performance monitoring activities, and for instrument trend monitoring.

Monitoring information will be provided by the ICCs to their respective ISTs, allowing the PIs/TLs to participate actively in the instrument monitoring activities, when desired or necessary for expert analysis.

The ICCs will periodically, and in response to anomalous conditions, provide instrument status reports to the EOC, to aid in the EOC's overall monitoring effort.

6.5.2.1.6 Instrument Analysis Service

The ICC performs analysis of instrument and related data to support the operation of the instrument. The analyses include trend analysis, performance analysis, and instrument configuration monitoring. Analysis may be performed on real-time data, **spacecraft recorded** ~~playback~~ data, or data from the history log. The ICC may receive quick-look science data in CCSDS packets directly from EDOS. The ICC can also receive quick-look science data products from a ~~DAAC~~ **DADS**. The ICC maintains the ground image of the instrument microprocessor memory and compares this image to memory dumps. The ICC provides fault management for the instrument and participates in fault resolution of instrument and ICC interface faults. The ICC coordinates the analysis with the IST.

6.5.2.1.7 Instrument Data Management Service

The ICC maintains the Instrument Data Base (IDB). The IDB contains the instrument-unique parameters required to operate the instrument, such as command formats and telemetry parameter limits. The ICC is capable of checking and modifying records in the IDB.

The ICC stores a record of the operations activities in the history log. This includes all electronic messages with external systems, instrument operator actions, schedules, and so on. The data is stored in the ICC for seven days and then provided to the DADS for archiving. Data can be extracted by time and data type to support operations analysis.

6.5.2.1.8 Element Management Service

The ICC Element Management Service will have capabilities to schedule ICC activities, control and monitor the configuration of its resources, monitor performance, generate reports, and provide operations testing. It will coordinate operations with EDOS**, the EOC** and the SMC.

The Local System Management tools will be used to provide appropriate ICC element management functions except where there are overriding operational considerations.

6.5.2.1.9 User Interface Service

The User Interface Service in the ICC will provide authorized ICC personnel with access to every ICC function, including planning and scheduling, control and monitoring, and analysis and management of its instrument and the ICC itself. This User Interface Service will consist of two main capabilities: a set of mechanisms through which the operator can specify actions to be taken by the system and provide responses and input, and a display function through which the user can monitor the instrument, the ICC components, and the results of user requests. The user interface will include a high-level interactive control language. The control language will provide the operator with the ability to input requests in a variety of forms (e.g., directives, procedures, **and pointing devices** ~~graphics~~). As a collection of related directives, user interface language procedures allow the user to automate the execution of functions that require multiple directives. Within the user interface language procedures, the language also provides other features such as nesting, conditional constructs, and timed execution.

The display portion of the User Interface Service primarily involves the display of information to the user in the form of text and graphical displays.

6.5.2.1.10 IST

The IST will support the input of DARs into the ECS system. Tools that are co-resident with the IST will be provided to aid in the construction of the DAR and account checking with SMC prior to the submission of the DAR and subsequent transmission to the IMS (via the ESN). The IST will provide access to DARs that are being initially processed by the ICC, so that the PI/TL may provide input into their processing.

The IST will provide access to the plans and schedules being developed by the ICC and EOC, so that the PI/TL may review the planned instrument use. In addition, the IST will permit the PI/TL to have interactive scheduling capabilities to aid in the decision making of the schedule generation. The interactive scheduling at the IST will permit only the generation of "what-if" versions of the schedule and not the final schedule.

The IST will permit the PI/TL to transmit to the ICC instrument microprocessor memory loads and updates to the ICC Instrument Data Base (IDB). The IST will also provide the capability for the PI/TL to issue command requests to the ICC, if urgent commands are deemed necessary by the PI/TL or designee. The PI/TL will have access to command uplink status via the IST, as received from the ICC.

To support anomaly and long-term analysis, in addition to the calibration of the instrument, the IST will receive and display engineering telemetry from the ICC. The IST will also provide the capability to display quick-look products after receipt from the ICC. Instrument status, as determined by the ICC, will be made available to the IST, upon request.

6.5.2.2 Conceptual ICC Architecture

The ICCs are the elements of the FOS that have the responsibility for planning and scheduling the individual instruments activities, commanding the instruments, and monitoring the instruments' health and safety.

The ICCs provide plans and activity specifications to the EOC, submit instrument commands to the EOC, and provide instrument status reports to the EOC.

The ICCs receive telemetry from EDOS for monitoring instrument activities and processed quick-look science data from the DAAC for general instrument health assessment.

An ICC can involve the instrument PI/TL in its activities through an IST resident at the PI/TL site.

6.5.2.2.1 ICC Interfaces

The Conceptual ICC Context Diagram is shown in Figure ~~6.5.2.2.1-1~~ **6-3**. The ICCs interfaces with other EOSDIS elements and external entities are described below.

6.5.2.2.1.1 ICC/EOC Interface

~~The ICC receives DARs from EOC for initial instrument analysis. In return, the ICC provides the result of the analysis, which may include a further refinement of the DAR and an assessment of its technical feasibility and its consistency with the LTIP and LTSP.~~

Based on the DARs that the ICC has received, its plans for instrument maintenance and instrument calibration, spacecraft activities that will impact the instrument, and other guidelines provided by the EOC, each ICC will provide a proposed ~~STIP~~ **instrument resource profile, or an instrument resource deviation list** to the EOC for its instrument. The EOC, in response, will send an overall spacecraft and instrument operations plan, designated a ~~STOP~~ **preliminary resource schedule** which may include **requested resource** changes ~~to the STIP~~ required to eliminate any conflicts.

Once the ~~STOP~~ **preliminary resource schedule** (which describes activities for the ~~next 28 days~~ **following target week**) has converged, the ICC will produce an ~~IAS~~ **instrument activity list or an instrument activity deviation list** of all its instrument activities for the following week, based on the ~~STOP~~ **preliminary resource schedule, instrument collection activities and instrument and spacecraft support activities.** ~~and the resource guidelines identified by the EOC~~. The proposed ~~IAS~~ **instrument activity list or an instrument activity deviation list** is sent to the EOC. This includes a refinement of resources expected to be used and more exact timeline of activities than what was provided for the ~~STOP~~ **preliminary resource schedule.** The EOC generates a spacecraft and instrument level ~~CFS~~ **detailed activity schedule** which it provides to the ICC.

The ICC provides instrument commands and other data to the EOC for uplink. This uplink data is based on the ~~CFS~~ **detailed activity schedule** or is given in response to emergency/contingency situations. The uplink data may include instrument commands, microprocessor loads, or table loads. The EOC provides an uplink status to the ICC for each of these types of uplink data.

Preplanned emergency/contingency commands are also provided to the EOC. The EOC will be able to issue emergency/contingency commands to the instrument independent of the ICC, although normally only as a backup. The EOC will provide notification to the ICC if these commands are issued. On a periodic basis, the ICC reports instrument status to the EOC; this status is also provided in the event of certain anomalous activities.

6.5.2.2.1.2 ICC/IST Interface

The ICC provides planning information to the IST for review by the PI/TL. The PI/TL can either approve the plan or provide modifications. The same mechanism also exists for the instrument schedule, and is primarily used for resolving conflicts.

Instrument monitoring data received and processed at the ICC is made available to the IST on request. **This includes instrument housekeeping and instrument engineering data, as well as spacecraft housekeeping telemetry.**

Requests for commands to be uplinked can be issued at the IST and then sent to the ICC. This would only be for anomalous events or to modify an existing sequence (that does not exceed allocated resources) to take into account a late-breaking scientific event. In addition, instrument microprocessor loads can be sent by the IST to the ICC.

The IST sends to the ICC instrument operations data that includes command-mnemonic-to-bit-sequence definitions and the data needed at the ICC for instrument monitoring, such as parameter value ranges. **In addition, the IST will be able to provide a command request to the ICC.**

The IST will be able to view and modify DARs received from the ICC. The IST will be able to provide the ICC with DAR acceptance notification or rejection notification along with the applicable rationale.

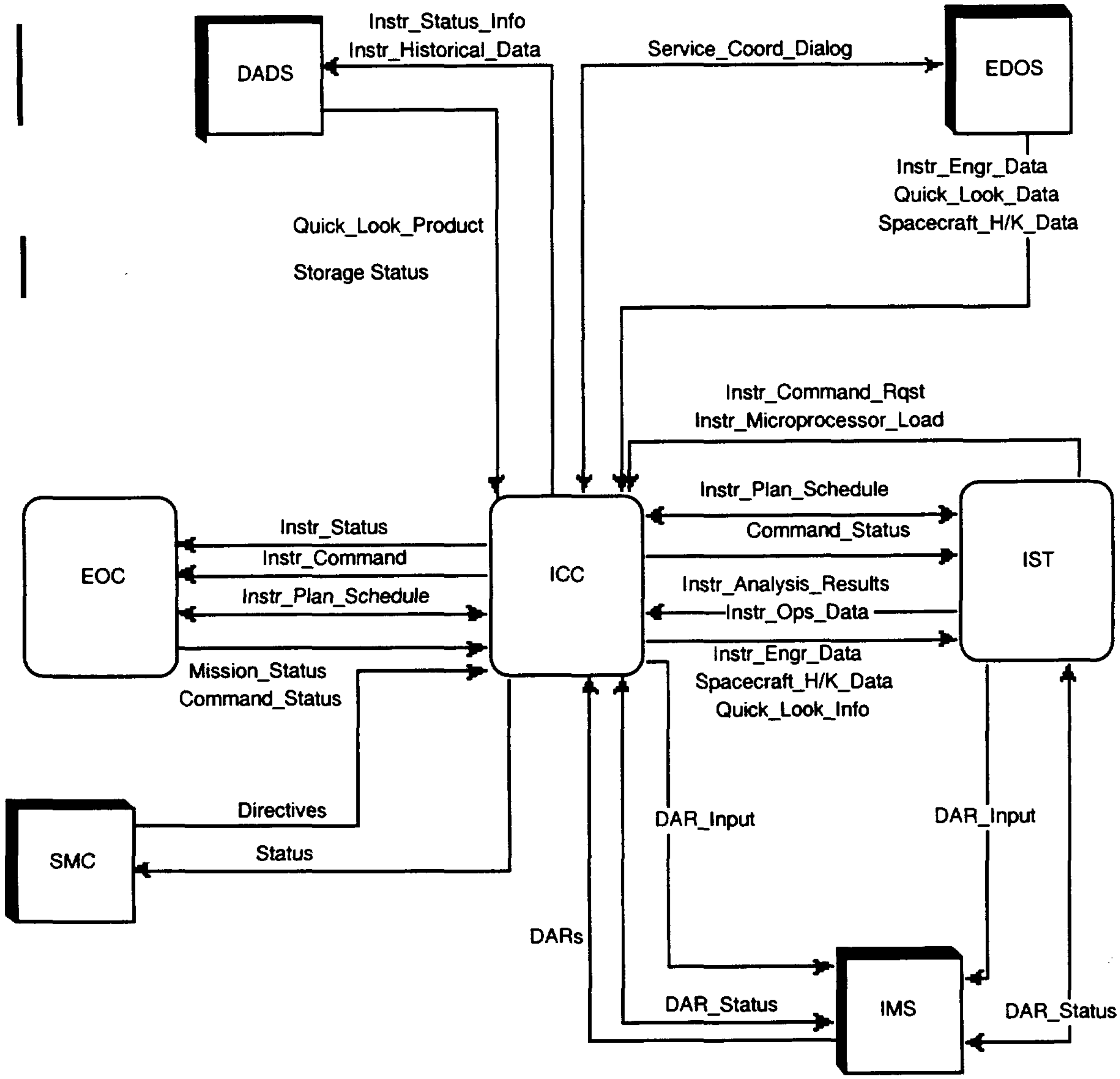


Figure 6-3. Conceptual ICC Context Diagram

6.5.2.2.1.3 ICC/SMC Interface

The ICC receives resource directives, including the LTSP and the LTIP, from the SMC and returns ICC management and operations status.

6.5.2.2.1.4 ICC/IMS Interface

~~The ICC interfaces with the IMS to initiate DARs. The IMS provides its status upon request. The ICC also provides instrument information needed for DAR generation at the IMS.~~

The ICC will be able to generate and submit DARs to the IMS. The IMS, which provides the focal point for submitting DARs within ECS, will forward all DAR submittal requests to the ICC for analysis. The ICC will accept or reject the DAR, and notify the IMS of its status and rationale. The ICC will also provide the IMS with DAR status information upon request from the IMS or upon change to the DAR or DAR status.

6.5.2.2.1.5 IST/IMS Interface

The IST interfaces with the IMS to initiate DARs. The IMS provides its status upon request.

6.5.2.2.1.6 ICC/DADS Interface

The ICC transmits instrument command history data and instrument engineering status data to a DADS for archiving. The ICC receives storage status which indicates the success or failure of storage of the data sent to the DADS by the ICC.

The ICC can receive processed quick-look science data from a DADS, if applicable for the instrument.

6.5.2.2.1.7 ICC/EDOS Interface

The ICC receives instrument telemetry packets from EDOS, including spacecraft and instrument housekeeping data packets, instrument engineering data packets, and a subset of data to be used as quick-look data. The ICC extracts instrument housekeeping data and relevant spacecraft parameters from the spacecraft and instrument housekeeping data packets. For some instruments, the instrument engineering data may be received embedded in the science data packets, in which case the ICC will extract its engineering data from the science data packets. The ICC interfaces with EDOS to request changes in data delivery services and to make inquiries into data delivery status. EDOS provides the ICC with responses to the data delivery service requests and replies to status inquiries.

6.5.2.2.1.8 ICC/Science User Interface

The ICC interfaces with the science users who have issued a DAR, when the DAR needs clarification or modification. This is done on an as needed basis.

6.5.2.2.2 ICC Data Flows

Table ~~6.5.2.2.2-1~~ **6-2** describes the general input, output, and process data flows that support the ICC services and functions.

Table 6-2. Conceptual ICC Data Flows (Page 1 of 2)

From	To	Data Item	Description
ICC	EOC	Instr_Plan_Schedule	Instrument resource needs and plans, instrument activity list and instrument activity deviation list.
		Instr_Command	Commands and other data to be forwarded to EDOS for uplink and then to be distributed to the instrument in real time or delayed onboard. Includes real-time commands, stored commands, stored tables, instrument microprocessor loads, and contingency data.
		Instr_Status	High-level instrument status information, obtained from instrument telemetry, including identification of anomalous events.
EOC	ICC	Instr_Plan_Schedule	Information on spacecraft resource availability, coordinated observation plans, spacecraft plans, guideline and priority updates, and authorized instrument schedules.
		Mission_Status	Mission status information, including spacecraft status and contingency action information.
		Command_Status	Command uplink status, including when commands will be or were uplinked.
SMC	ICC	Directives	ICC management and operations directives, including science policy and guidelines from the IWG plan in the LTSP and the LTIP.
ICC	SMC	Status	ICC management and operations status.
ICC	IST	Instr_Plan_Schedule	Information the PI/TL would require to approve a plan or a schedule for his/her instrument, or suggest modifications to eliminate conflicts, and requests for analysis of a DAR.
		Command_Status	Status of commands requested by the PI/TL.
		Instr_Engr_Data	Both processed and raw telemetry data received from the instrument provided on an as-requested basis to the IST.
		Quick_Look_Info	A subset of science data, as defined by the instrument, provided on an as-requested basis to the IST.
		Spacecraft_H/K_Data	A subset of the Spacecraft engineering data provided on an as-requested basis to the IST.
IST	ICC	Instr_Plan_Schedule	Instrument planning and scheduling information, including modification or approval of an instrument plan or schedule, as provided by the TL/PI to the ICC.
		~~Instr_Microprocessor_Load~~	<MOVED DOWN IN TABLE>
		~~Instr_Command_Rqst~~	<MOVED DOWN IN TABLE>
IST	ICC	Instr_Analysis_Results	Results of analysis on DARs, instrument housekeeping and engineering data, and/or quick look data or products
		Instr_Ops_Data	Instrument-specific command and/or telemetry information needed at the ICC. It consists of: Instr_ Microprocessor_Load, Instr_Command_Rqst, and Instrument Monitoring.

Table 6-2. Conceptual ICC Data Flows (Page 2 of 2)

From	To	Data Item	Description
		Instr_ Microprocessor_ Load	Memory load for the instrument microprocessor. This could be a load of executable code, a table, or the instrument microprocessor's stored command memory, if applicable. <MOVED FROM ABOVE>
		Instr_Command_ Rqst	A request for a command or series of commands from the IST to the ICC in response to anomalous events or as a means to update commands for late occurring scientific phenomena. <MOVED FROM ABOVE>
ICC	IMS	DAR_Input	Submittal of a DAR at the ICC.
		DAR_Status	Request for status of DAR submitted at the ICC and response.
IMS	ICC	DAR_Status	Status of DAR submitted at the ICC and response.
		DARs	Submittal of DAR to ICC for processing.
IST	IMS	DAR_Input	Submittal of a DAR at the IST.
		DAR_Status	Request for status of DAR submitted at the IST and response.
IMS	IST	DAR_Status	Status of DAR submitted at the IST and response.
ICC	DADS	Instr_Historical_Data	History of instrument operations, including commands sent and all indications of successful and failed commands, for archival.
		Instr_Status_Info	Instrument status information resulting from the ICC's analysis of instrument data, for archival.
DADS	ICC	Quick_Look_Product	Processed subsets of expedited science data that provides a limited view of the operations of the instrument from a scientific acquisition perspective.
		Storage_Status	Information indicating success or failure of storage for data sent to a DADS by the ICC
ICC	EDOS	Service_Coord_Dialog	Requests for changes in data delivery services or status, etc.
EDOS	ICC	Instr_Engr_Data	Telemetry data in CCSDS packets received from the instrument, used primarily for health and safety and calibration purposes. Includes instrument microprocessor memory dump data.
		Spacecraft_H/K_Data	Spacecraft engineering data in CCSDS packets that is used primarily for health and safety and calibration purposes. Includes ancillary data.
		Quick_Look_Data	Subsets of expedited science data in CCSDS packets that provides a limited view of the operations of the instrument from a scientific acquisition perspective.
		Service_Coord_Dialog	Responses to the requests received from the ICC for data delivery services or status.

6.5.2.3 Functional Requirements

The ICC requirements stated in this section refer to the operations of a single instrument.

It should be noted that an IP element responsible for controlling an instrument on a U.S. spacecraft is assumed to comply with the ICC requirements of this section.

ICC-0005 **The ICC shall interface with the following external elements per the requirements specified in the referenced Interface Requirements Documents:**

a. EDOS, per the ECS to EDOS IRD

b. Instruments Command and Telemetry Databases, per the ECS to Spacecraft and Instruments Command and Telemetry Databases IRD.

ICC-0010 The GSFC ~~ICF~~ **ICC** shall be responsible for planning, scheduling, commanding, and monitoring the instruments allocated to GSFC in Table D-1, Instrument Manifest.

ICC-0020 The ICC shall be capable of interfacing with one or more local and/or remote ISTs for the instrument supported by the ICC.

ICC-0030 The ICC shall have the capability to notify the TL or instrument PI at the IST of, at a minimum, the following:

a. Conflicts found in planning and scheduling

b. Arrival of instrument engineering data

c. Arrival of quick-look data

d. Instrument anomalies found during instrument monitoring

ICC-0040 The ICC shall receive the LTSP and LTIP from the SMC.

ICC-0050 An ICC shall have the capability to interface with other ICCs both electronically and by voice to facilitate, at a minimum, the following:

a. Planning of coordinated operations

b. Resolution of conflicts

c. Exchange of instrument status

ICC-0055 The ICC shall interface with EDOS for coordinating EDOS-provided services (e.g., data delivery service messages, status).

ICC-0070 The ICC shall be capable of accommodating instrument team-provided software and/or hardware to perform functions such as:

a. DAR processing

b. Planning

c. Scheduling

d. Quick-look processing

e. Analysis

f. Onboard microprocessor management

6.5.2.3.1 DAR Processing Service

6.5.2.3.1.1 DAR Generation

ICC-1010 The ICC shall provide the IMS with instrument information needed by the IMS for DAR generation.

ICC-1020 The ICC shall be able to generate and submit DARs to the IMS.

ICC-1040 The ICC shall interface with the IMS to receive status of the DARs generated at the ICC.

6.5.2.3.1.2 DAR Analysis

ICC-1041 The **ICC** ~~EOC~~ shall maintain the status of all DARs **submitted to it from the IMS.**

MOVED -- Moved from EOC-1140.

ICC-1042 The ~~EOC~~ **ICC** shall accept a DAR, ~~not related to a TOO observation,~~ which requires the use of instruments on the EOS spacecraft, up to **three weeks before the start of the target week.** ~~28 days before the time of the observation.~~

MOVED -- Moved from EOC-1050.

ICC-1044 The ~~EOC~~ **ICC** shall be able to accept a DAR or a DAR modification, ~~not related to a TOO observation,~~ which requires the use of instruments on the EOS spacecraft, between **three weeks and one week before the start of the target week,** ~~28 and 7 days before the observation, although such a DAR will be~~ subject to availability of resources left unallocated ~~by the planning and scheduling process that begins 28 days before the observation~~.

MOVED -- Moved from EOC-1051.

ICC-1050 The ICC shall receive ~~a DAR (for analysis) that is forwarded by the EOC~~ **DARs and their updates from the IMS.**

ICC-1060 The ICC shall be capable of processing a DAR that requires coordination ~~with~~ **between multiple instruments** ~~other observations~~.

ICC-1070 The ICC shall be capable of processing a DAR that specifies primary requests with alternatives in priority order.

ICC-1080 The ICC shall evaluate, and accept or reject a DAR **or DAR update, and notify the IMS** on the basis of at a minimum the following:

a. Completeness and consistency of the DAR

b. Instrument capabilities and constraints

c. ~~EOC assigned priorities~~ **Priorities** based on the LTSP

d. LTIP requirements and constraints

e. Availability of resources

ICC-1082 The ~~EOC~~ **ICC** shall assign a priority to each DAR, based on a conformity check against the LTSP **and the LTIP**.

MOVED -- from EOC-1080

ICC-1090 The ICC shall have the capability to send a DAR evaluation request to the IST.

ICC-1100 The ICC shall accept from the IST either DAR acceptance notification with updates, if any, or DAR rejection notification along with the reasons for rejection.

ICC-1105 The ICC shall have the capability to communicate with a DAR originator(s) for modification and for clarification of DARs.

ICC-1110 The ICC shall be able to evaluate a DAR **or DAR update** within 24 hours of receipt from the ~~EOC~~ **IMS**.

ICC-1115 The ~~EOC~~ **ICC** shall accept a DAR for a TOO observation up to 6 hours before the actual observation.

MOVED -- from EOC-1060

ICC-1130 In support of a TOO observation, the ICC shall be able to evaluate the corresponding DAR received from the ~~EOC~~ **IMS** within 15 minutes.

ICC-1140 The ICC shall be capable of processing a DAR that specifies observations in terms of times, targets (geographical locations), or both.

ICC-1150 The ICC shall be capable of using predicted orbit data and related information for the U.S. spacecraft, to determine the times during which specified targets will be within view of the specified instruments.

ICC-1160 The ICC shall provide the ~~EOC~~ **IMS** ~~with either DAR acceptance notification with updates, if any, or DAR rejection notification along with the reasons for rejection~~ **with DAR status information upon initial determination of acceptance or rejection, upon request from the IMS, or upon change to the DAR or DAR status.**

ICC-1170 The ICC shall maintain a record of its approved DARs for inclusion in ~~a STIP and/or IAS~~ **its plans and schedules.**

6.5.2.3.2 Planning and Scheduling Service

ICC-2010 The ICC shall have the capability to access the EOC planning and scheduling information.

ICC-2015 The ICC shall have the capability to access and execute **EOC "what-if" functions for planning and scheduling analysis** ~~the planning and scheduling functions in the EOC.~~

ICC-2017 The ICC shall provide the capability ~~for the TL or instrument PI~~ at the IST to access planning and scheduling functions in the ICC.

ICC-2020 Upon request from the ~~TL or instrument PI~~ **PI/TL** at the IST, the ICC shall provide the IST with planning and scheduling information, which includes, at a minimum, the following:

a. LTSP and LTIP

b. Current resource availability information

c. Current predicted orbit data and related information

d. Plans and schedules

ICC-2050 The ICC shall identify and resolve instrument planning and scheduling conflicts of its instrument based on, at a minimum, the following:

a. Resource and time constraints

b. In situ observation dependency

c. Coordinated observation dependency among instruments

d. Priorities set by the LTSP and LTIP

ICC-2055 The ~~EOC~~ **ICC** shall notify the IMS of the planned or scheduled observation times associated with each DAR and any subsequent changes to the times.

MOVED -- Moved from EOC-2150.

ICC-2060 The ICC shall reintroduce applicable requested activities in its planning and scheduling function when the activity did not occur due to a deviation from the schedule.

~~6.5.2.3.2.1 Planning~~

ICC-2110 The ICC shall be capable of converting a DAR into ~~a general-purpose scheduling language format~~ **scheduling directives** suitable for inclusion in ~~the STIP~~ **its plans and schedules.**

ICC-2115 The ICC shall ~~provide the capability to generate an ISAR based on routine instrument maintenance needs~~ **have the capability to plan and schedule instrument maintenance activities.**

ICC-2120 The ICC shall accept ~~ISARs~~ **requests for instrument support activities** from the IST.

ICC-2130 The ICC shall send ~~ISAR~~ **requests for instrument support activity** receipt notification to the IST.

ICC-2135 The ~~ISARs~~ **requests for instrument support activities** received from the IST or generated by the ICC shall include at a minimum the following:

a. ~~ISAR~~ **Request for instrument support activity** identifier

b. Time window during which activity may be performed and duration of the activity

c. Sequencing requirements with other instrument activities

d. Instrument resource requirements for the activity

e. Textual description of the activity

ICC-2140 At least once each week, the ICC shall build ~~a STIP for its instrument describing instrument operations currently planned for the following 28-day period, starting the next week~~ **an instrument resource profile or an instrument resource deviation list (when a baseline resource profile exists for the instrument), which includes a description of instrument operations currently planned for the target week.**

ICC-2150 The ICC shall accept from the EOC a notification of rejection of ~~STIP activities~~ **its instrument activities proposed in the instrument resource profile or instrument resource deviation list.**

ICC-2170 When the ICC encounters a conflict while building or updating ~~a STIP~~ **an instrument resource profile (or instrument resource deviation list)**, and the ICC does not have sufficient information to resolve the conflict, the ICC shall forward a request for its resolution to the ~~TL or instrument PI~~ **PI/TL** at the IST.

ICC-2180 The ICC shall accept from the IST ~~notification of STIP conflict resolution~~ **information regarding the resolution of conflicts encountered while building or updating an instrument resource profile or instrument resource deviation list.**

ICC-2190 The ICC shall build or update ~~the STIP based on at a minimum the following~~ **its instrument resource profile, or when a resource profile exists, its instrument resource deviation list, based, at a minimum, on the following:**

a. Accepted DARs **(if any) and/or anticipated observations**

b. ~~ISARs~~ **Instrument support activities**

c. LTSP ~~goals and priorities~~ **and LTIP**

~~d. LTIP requirements~~

de. Current resource availability ~~information~~

ef. Current predicted orbit data and related information

fg. ~~STIP activity rejection~~ **Rejection** notification from the EOC **of activities that can not be accommodated in the preliminary resource schedule**

gh. Existing ~~STOP~~ **preliminary resource schedule**

ICC-2210 The ICC shall ~~be able to modify the STIP interactively to resolve planning conflicts for its instrument~~ **ensure that its instrument resource profile (or instrument resource deviation list) contains no internal conflicts.**

ICC-2220 The ICC shall be able to generate the ~~STIP~~ **instrument resource profile** in both machine usable and human readable forms. ~~to describe at a minimum the following:~~

~~a. Identification of accepted DARs~~

~~b. Objectives of each observation~~

~~c. Power requirements for each activity~~

~~d. Data rate and volume for each activity~~

~~e. Approximate times and instrument modes for each activity~~

~~f. Specified tolerance limits for each observation~~

~~g. Environmental characteristics for each instrument mode~~

~~h. Alternative activities for contingency situations~~

~~i. Real-time requirements (for command uplink and telemetry downlink)~~

~~j. DARs not accommodated in the previous STIP~~

ICC-2230 **When generated, the** ~~The~~ ICC shall provide the EOC with ~~the STIP and any updates~~ **its instrument resource profile or, when a resource profile exists, an instrument resource deviation list** ~~when generated~~.

~~6.5.2.3.2.2 Scheduling~~

ICC-2250 The ICC shall accept the ~~STOP~~ **preliminary resource schedule** from the EOC.

~~ICC-2260 Upon request from the TL or instrument PI at the IST, the ICC shall provide the IST with the STOP.~~

DELETED -- Subsumed by ICC-2020.

ICC-2270 ~~At least once per day, the ICC shall build a 7-day IAS for the instrument operations for the following 7 days~~ **The ICC shall be capable of generating or updating, at least once each day, an instrument activity list or an instrument activity deviation list (when an activity profile exists for the instrument) nominally covering the next 7 days.**

ICC-2280 The ICC shall ~~be able to~~ generate or update ~~the IAS based on~~ **the instrument activity list, or when an activity profile exists, the instrument activity deviation list, based, at a minimum, on the following**:

a. DARs ~~accepted after the STOP has been generated~~

b. ~~ISARs accepted after the STOP has been generated~~ **Instrument support activities**

c. LTSP ~~priorities~~ **and LTIP**

~~d. LTIP requirements and constraints~~

de. ~~STOP~~ **Preliminary resource schedule**

ef. Current resource availability information

fg. Current predicted orbit data and related information

gh. Responses to contingency/emergency conditions

hi. Rejection notification ~~of IAS activities~~ from the EOC **of the activities that cannot be accommodated in the detailed activity schedule**

ICC-2290 The ICC shall ~~be able to~~ generate the ~~IAS~~ **instrument activity list or the instrument activity deviation list (when an activity profile exists for the instrument)** in both machine-usable and human-readable forms, to describe **for each activity**, at a minimum, **as many of** the following **that apply**:

a. ~~Identification of the accepted DARs~~ **Activity identifier including traceability to DARs and/or instrument support activities.**

b. Objectives ~~of each activity~~

c. ~~Power profile~~ **Resource requirements**

~~d. Data rate profile~~

de. Start time constraints and duration ~~for each activity~~

ef. Instrument modes as a function of time ~~for each activity~~

fg. Pointing angles and field of view (FOV) ~~for each activity~~

gh. Specified tolerance limits ~~for each activity~~

hi. ~~Environmental characteristics for each instrument mode~~ **Disturbances caused**

ICC-2300 The ICC shall ~~have the capability to~~ accept from the EOC a notification of rejection of ~~IAS~~ **instrument** activities.

ICC-2320 The ICC shall have the capability for ICC personnel to interactively modify the ~~IAS~~ **instrument activity list, or when an activity profile exists, the instrument activity deviation list,** to resolve schedule conflicts.

DELETED -- Conflict resolution presented in ICC-2050.

~~ICC-2340 The ICC shall notify the EOC of all changes to the DARs, including rejection along with the reasons for rejection, whenever a change occurs.~~

DELETED -- EOC DAR function is now the responsibility of the ICC.

ICC-2350 In support of a TOO observation **or a late change**, the ICC shall ~~be capable of updating the IAS~~ **update the instrument activity list or the instrument activity deviation list (when an activity profile exists for the instrument)** within 8 hours, if the DAR affects existing ~~IAS events~~ **instrument activities** or creates new conflicts.

~~ICC-2360 In support of a critical instrument support activity, the ICC shall be capable of updating the IAS within 8 hours, if the ISAR affects existing IAS events or creates new conflicts.~~

DELETED -- Subsumed by ICC-2350.

ICC-2370 In support of a TOO observation, the ICC shall ~~be capable of updating the IAS~~ **update the instrument activity list or the instrument activity deviation list (when an activity profile exists for the instrument)** within 30 minutes, if the DAR does not affect existing ~~IAS events~~ **instrument activities** or create new conflicts.

ICC-2380 In support of a **late change** ~~critical instrument support activity~~, the ICC shall be capable of updating the ~~IAS~~ **instrument activity list** within 75 minutes, if the ~~ISAR~~ **request for instrument support activity** does not affect existing ~~IAS~~ **instrument activity list** events or create new conflicts.

ICC-2390 The ICC shall provide the EOC with ~~the IAS and any updates upon generation~~ **the instrument activity list or instrument activity deviation list (when an activity profile exists for the instrument) and any updates thereto, when generated.**

ICC-2400 The ICC shall have the capability to update ~~the IAS~~ **the instrument activity list or instrument activity deviation list (when an activity profile exists for the instrument)** in response to instrument malfunctions or other special events that affect the continuation of the existing schedule.

ICC-2410 The ICC shall update ~~the IAS~~**, for historical purposes, its instrument activity list (or instrument activity deviation list)** within 24 hours of issuance of the unscheduled commands ~~for historical purposes~~.

ICC-2420 The ICC shall send to the IST the generated ~~IAS~~ **instrument activity list (or instrument activity deviation list)** to be reviewed and/or ~~authorized~~ **approved** by the ~~TL or instrument PI~~ **PI/TL**.

ICC-2430 The ICC shall notify the ~~TL or instrument PI~~ **PI/TL** at the IST of any problems encountered while building or updating ~~the IAS~~ **its instrument activity list (or instrument activity deviation list)**.

ICC-2450 The ICC shall accept from the IST notification of ~~IAS~~ problem resolution **regarding the instrument activity list (or the instrument activity deviation list)**.

6.5.2.3.3 Command Management Service

ICC-3010 The ICC shall validate ~~all instrument core-stored commands and tables and microprocessor memory loads~~ **instrument loads, SCC-stored instrument commands, and/or SCC-stored instrument tables, as appropriate,** that are generated at the ICC. ~~using the instrument-specific command information.~~

ICC-3020 The ICC shall accept the ~~CFS~~ **detailed activity schedule** or its updates from the EOC.

ICC-3040 The ICC shall be capable of **generating** , at least once each day, ~~generating routine~~ instrument **loads, SCC-stored instrument commands, and/or SCC-stored instrument tables** ~~commands and microprocessor memory loads~~ based on the **detailed activity schedule** ~~CFS and using instrument-specific command information.~~

ICC-3050 The ICC shall be able to generate a command-to-memory location map for instrument-stored command loads.

ICC-3060 ~~The ICC shall be able to generate and validate routine instrument commands and microprocessor memory loads for 24 hours of instrument operation, in less than 1 hour~~. **The ICC shall generate and validate, in less than 1 hour, the instrument loads, SCC-stored instrument commands, and/or SCC-stored instrument tables for 24 hours of operation of its instrument.**

ICC-3070 In support of a TOO observation or late change, the ICC shall ~~be capable of generating and validating~~ **generate and validate** the corresponding commands within 25 minutes of receiving an updated ~~CFS~~ **detailed activity schedule** from the EOC, if the corresponding observation does not impact previously scheduled activities.

ICC-3071 In support of a TOO observation, the ICC shall be capable of generating and validating the corresponding commands within 55 minutes of receiving an updated ~~CFS~~ **detailed activity schedule** from the EOC, if the corresponding observation impacts previously scheduled activities.

~~ICC-3084 In support of a critical instrument support activity, the ICC shall be capable of generating and validating the corresponding commands within 25 minutes of receiving an updated CFS from the EOC, if the corresponding activity does not impact previously scheduled activities.~~

DELETED -- Subsumed by ICC-3070.

ICC-3085 In support of a **late change** ~~critical instrument support activity~~, the ICC shall be capable of generating and validating the corresponding commands within 115 minutes of receiving an updated ~~CFS~~ **detailed activity schedule** from the EOC, if the corresponding activity impacts previously scheduled activities.

ICC-3090 The ICC shall generate, validate, and store, as command groups, preplanned instrument commands for later use in emergency situations to protect the health and safety of its instrument.

ICC-3100 The ICC shall be able to generate, validate, and store preplanned contingency instrument commands to support specific TOO observations.

ICC-3110 The ICC shall be able to generate, validate, and store preplanned contingency instrument commands ~~to support critical instrument support activities~~ **to be used in event of instrument anomalies.**

ICC-3150 The ICC shall be able to accept from the ~~TL or instrument PI~~ **PI/TL**, via the IST, instrument ~~microprocessor~~ memory loads, including software and table updates.

ICC-3160 Upon request from the ~~TL or instrument PI~~ **PI/TL** at the IST, the ICC shall provide the IST with at a minimum the following:

a. Current ~~CFS~~ **detailed activity schedule**

b. Instrument commands**/tables** and ~~memory~~ **instrument** loads

c. Instrument command status **information**

6.5.2.3.4 Commanding Service

ICC-3210 The ICC shall provide the EOC with, ~~as applicable, instrument microprocessor memory loads, core-stored instrument commands, core-stored instrument tables, instrument command groups,~~ **instrument loads, SCC-stored instrument commands, SCC-stored instrument tables, preplanned real-time instrument commands,** and associated information that includes, at a minimum, the following:

a. Instrument identifier

b. Schedule identifier, if applicable

c. Critical command information

~~d. Expected resource usage~~

ICC-3220 The ICC shall have the capability to accept, via the IST, an instrument command request from the ~~TL or instrument~~ **PI/TL.**

ICC-3230 The ICC shall ~~check~~ **evaluate** a command request from the IST against the current ~~CFS~~ **detailed activity schedule** to determine whether it can be met with the corresponding commands without impacting previously scheduled activities.

ICC-3240 The ICC shall generate and validate **a preplanned** instrument ~~command groups~~ **command request** in response to an instrument command request from the ~~TL or instrument~~ **PI/TL** at the IST.

ICC-3250 The ICC shall provide the EOC with **a preplanned** instrument ~~command groups~~ **command request**, in response to an instrument command request from the ~~TL or instrument~~ **PI/TL** at the IST, within 30 minutes of receiving the request.

ICC-3262 In support of a TOO observation **or a late change**, the ICC shall ~~be capable of transferring~~ **transfer** the corresponding ~~commands~~ **command request** to the EOC within 5 minutes of generation and validation of the commands.

~~ICC-3266 In support of a critical instrument support activity, the ICC shall be capable of transferring the corresponding commands to the EOC within 5 minutes of generation and validation of the commands.~~

DELETED -- Subsumed by ICC-3262.

ICC-3270 The ICC shall be able to generate and validate emergency/contingency instrument command groups in emergency/contingency situations.

ICC-3280 The ICC shall have the capability to provide the EOC with instrument command groups, within 1 minute of a predefined emergency/contingency situation.

ICC-3300 The ICC shall be capable of retrieving validated and stored instrument command groups and initiating transfer to the EOC, within 1 second of operator initiation.

ICC-3360 The ICC shall provide an instrument command group with a single emergency instrument command to the EOC within 200 milliseconds of operator initiation.

ICC-3370 The ICC shall provide the capability to verify the successful receipt and execution of instrument commands.

ICC-3380 The ICC shall accept from the EOC instrument uplink status, which includes at a minimum the following:

a. Receipt at the EOC

b. Validation status as determined by the EOC

c. Receipt at the spacecraft

ICC-3400 Upon request from the ~~TL or instrument~~ **PI/TL** at the IST, the ICC shall provide the IST with instrument command status, which includes at a minimum the following:

a. Receipt at the EOC

b. Validation status as determined by the EOC

c. Receipt at the spacecraft

d. Execution at the instrument

ICC-3420 The ICC shall provide the IST with command request status, which includes the receipt of the command request at the ICC and the status of for the corresponding instrument command groups.

ICC-3430 The ICC shall accept from the EOC command notification messages when emergency/contingency instrument commands are issued by the EOC.

6.5.2.3.5 Telemetry Processing Service

ICC-4010 Upon request from the ~~TL or instrument PI~~**PI/TL**, the ICC shall provide the IST with at a minimum the following:

a. Instrument housekeeping and engineering data

b. Spacecraft housekeeping data

c. Derived parameters for its instrument

ICC-4020 The ICC shall provide the capability to accept CCSDS packets from EDOS containing at a minimum the following data types:

a. Spacecraft and instrument housekeeping data

b. Instrument engineering data or instrument science data within which instrument engineering data is embedded

c. Instrument memory dump data

ICC-4040 The ICC shall be capable of simultaneously receiving real-time and ~~playback~~ **spacecraft recorder** data of all **EOS** telemetry data types.

ICC-4045 The ICC shall provide the capability to extract instrument housekeeping data and relevant spacecraft parameters from the spacecraft and instrument housekeeping data stream.

ICC-4050 The ICC shall be capable of extracting instrument engineering data from instrument science data.

ICC-4060 The ICC shall ~~be capable of supporting~~ **support** all **EOS** telemetry formats for instrument engineering data.

ICC-4070 The ICC shall provide the capability to receive **and report** data quality information with the incoming CCSDS packets as provided by EDOS.

ICC-4090 The ICC shall provide the capability to detect **and report** gaps in the telemetry data it receives.

ICC-4095 The ICC shall provide the capability to receive and process, ~~as appropriate,~~ non-telemetry data, which includes at a minimum the following:

a. Monitor blocks from the DSN, GN, and Wallops tracking station

b. Status messages from EDOS

ICC-4100 The ICC shall have the capability to perform instrument housekeeping and engineering data processing, which includes at a minimum the following:

a. Decommutation

b. Engineering unit conversion

c. Limit checking, flagging out-of-limit parameters

d. Derived parameter generation

e. Digital and discrete state determination

ICC-4110 The ICC shall support the definition of up to four sets of boundary limits for each non-discrete parameter, with each set including definitions for one or more upper and lower boundaries.

ICC-4120 The ICC shall provide the capability to accept temporary or permanent changes to limit definitions.

ICC-4130 The ICC shall have the capability to continuously process instrument housekeeping and engineering data in real time as it is being received.

ICC-4150 The ICC shall have the capability to provide ~~appropriate~~ event messages whenever a predetermined number of limit violations for a parameter is detected.

ICC-4160 The ICC shall have the capability to process ~~playback~~ **spacecraft recorder** instrument housekeeping and engineering data to determine instrument health and safety.

ICC-4170 The ICC shall provide the capability to determine the best estimate for instrument memory contents using two or more dumps.

ICC-4180 The ICC shall be able to process 24 hours of ~~playback~~ **spacecraft recorder** instrument housekeeping and engineering data within 2 hours.

ICC-4190 The ICC shall provide the capability to store ~~playback~~ **spacecraft recorder** telemetry data as it is being received.

ICC-4200 The ICC shall provide the capability to process stored telemetry data at an operator-selectable rate.

ICC-4210 The ICC shall be capable of extracting instrument engineering data from instrument science data. at science data rates up to 1.544 Mbps.

ICC-4220 The ICC shall be capable of receiving and processing real-time **housekeeping and engineering** data at rates up to 50 kbps.

ICC-4230 The ICC shall be capable of receiving and recording ~~playback~~ **spacecraft recorder** data at rates up to 1.544 Mbps.

6.5.2.3.6 Instrument Analysis Service

ICC-4410 The ICC shall provide the capability to perform analysis on real-time data, **spacecraft recorder** ~~playback~~ data, and data from the ICC history log.

ICC-4412 The ICC shall accept quick-look data in CCSDS packets from EDOS.

ICC-4415 The ICC shall accept and be capable of displaying processed quick-look products from the **DADS** ~~DAAC~~.

ICC-4420 The ICC shall receive spacecraft status data from the EOC.

ICC-4435 The ICC shall have the capability to process and display quick-look data.

ICC-4440 The ICC shall provide the capability to determine, for specified parameters over a specified time interval, at a minimum the following:

a. Minimum value

b. Maximum value

c. Mean value

d. Standard deviation of the parameter

e. Time and duration of limit violations

ICC-4450 The ICC shall provide the capability to plot specified parameters against other specified parameters or against time.

ICC-4460 The ICC shall provide the capability to time-correlate related instrument parameters.

ICC-4470 The ICC shall provide the capability to define, **check**, and manage instrument-specific operations procedures.

ICC-4480 The ICC shall have the capability to monitor and evaluate instrument environmental parameters.

ICC-4490 The ICC shall provide the capability for trend analysis of instrument parameters.

ICC-4500 The ICC shall provide the capability to generate instrument performance data based on the processing of quick-look data, instrument housekeeping data, and instrument engineering data.

ICC-4510 The ICC shall have the capability to generate instrument status data based on instrument performance data and instrument anomaly data.

ICC-4520 The ICC shall provide instrument status data to the EOC, periodically or upon detection of anomalies.

ICC-4540 The ICC shall monitor the configuration of the instrument.~~ and shall recommend reconfigurations.~~

ICC-4545 The ICC shall have the capability to recommend instrument reconfigurations.

ICC-4550 The ICC shall have the capability to compare and display selected instrument telemetry parameter values with the expected values based on, at a minimum the following:

a. Scheduled instrument operational mode

b. Trend analysis

c. Instrument-specific telemetry information in the IDB

ICC-4560 The ICC shall maintain a record of the instrument configuration, including the state ~~(e.g., on, off, idle, failed)~~ of instrument subsystems.

ICC-4570 The ICC shall-provide the capability to maintain a master ground image of the instrument memory.

ICC-4580 The ICC shall provide the capability to compare the master ground image and the instrument memory dump.

ICC-4590 The ICC shall provide the capability to detect, isolate, and resolve instrument failures and anomalies. ~~, in coordination with other affected elements~~.

ICC-4600 The ICC shall accept from the IST at a minimum the following:

a. Instrument anomaly notifications and instructions

b. ~~TL/PI~~ **PI/TL** analysis results

c. Calibration information

d. Performance data

ICC-4610 Upon request from the ~~TL or instrument PI~~ **PI/TL**, the ICC shall provide the IST with at a minimum the following:

a. Instrument performance assessment data

b. Quick-look data

6.5.2.3.7 Instrument Data Management Service

6.5.2.3.7.1 Instrument Data Base

ICC-4710 The ICC Instrument Data Base (IDB) shall include at a minimum the following:

a. Instrument housekeeping data formats

b. Instrument engineering data formats

c. Housekeeping and engineering parameter descriptions

d. Command descriptions

e. Syntactical rules for commands and operator directives

f. Operator directives

g. Display formats

h. Planning and scheduling definitions and constraints

i. Analysis algorithms

j. Report formats

k. Quick-look algorithms **(user supplied)**

l. Derived telemetry parameter equations

m. Parameter limits

n. Instrument characteristics

o. Command validation parameters

ICC-4720 The ICC shall maintain the latest two versions of the IDB.

ICC-4730 The ICC shall have the capability to modify records in the IDB.

ICC-4740 The ICC shall provide syntax and structure checking of the IDB.

ICC-4750 The ICC shall provide accounting information on the contents of the IDB.

ICC-4760 The ICC shall generate a report identifying any problems with the contents of the IDB.

ICC-4765 The ICC shall provide the ~~TL or instrument PI~~ **PI/TL** at the IST access to any data in the IDB.

ICC-4770 The ICC shall accept updates to the IDB from the IST.

ICC-4775 The ICC shall provide the EOC with the instrument-specific portion of the SDB and/or updates thereto.

6.5.2.3.7.2 Instrument History Log

ICC-4780 The ICC shall maintain a history log of instrument and ICC activities for at least 7 days, including at a minimum the following:

a. All messages sent and received

b. Engineering and housekeeping data

c. Operator requests/directives and responses

d. Commands

e. Microprocessor loads and dumps

f. Limits violations

g. Error conditions

h. Instrument status data

i. Executed schedules

j. Analysis results

k. Instrument calibration parameters

l. Spacecraft status information

m. Quick-look data

n. ICC reconfiguration information

ICC-4790 The ICC shall be capable of extracting data sets from the history log by specifying time and data type.

ICC-4800 The ICC shall provide a designated DADS with the instrument history log or subsets of the history log and associated metadata.

ICC-4810 The ICC shall accept storage status from the DADS indicating the success or failure of the storage of the history data.

ICC-4820 The ICC shall maintain the history log until the DADS has notified the ICC of successful storage.

ICC-4830 The ICC shall be capable of storing documentation on-line for operator support, including at a minimum the following:

a. Operator guides

b. Operational procedures

6.5.2.3.8 Element Management Service

ICC-6000 The ICC element shall collect the management data used to support the following system management functions:

a. **Fault management**

b. **Configuration management**

c. **Accounting management**

d. **Performance management**

e. **Security management**

f. **Scheduling management.**

6.5.2.3.8.1 ICC Scheduling

ICC-6005 The ICC shall have the capability to schedule its ~~resources~~ **systems and communications interfaces** that are used for its instrument operations and for other activities including maintenance, upgrade, sustaining engineering, testing, and training.

ICC-6010 The ICC shall ~~support the scheduling~~ **be capable** of **performing scheduled** interface and end-to-end tests with the external element involved, including the EOC, the SMC for other EOS elements, and EDOS for MO&DSD data delivery systems.

6.5.2.3.8.2 Operations Configuration Control

ICC-6020 The ICC shall establish its configuration**, including functional connectivity within the ICC and between the ICC and external interfaces,** for its instrument operations, tests, and maintenance~~, according to the schedule, and including the functional connectivity within the ICC and between the ICC and external interfaces~~.

ICC-6030 The ICC shall perform **prepass** operational readiness tests on the ICC and between the ICC and external interfaces **(via test messages)**.

ICC-6040 The ICC shall support reconfiguration to work around ICC faults and anomalies without interrupting other ongoing operations.

ICC-6060 The ICC shall ~~request~~ **allow** operator ~~confirmation~~ **override** for ICC reconfiguration requests that violate operational constraints.

ICC-6070 The ICC shall manage initialization and shutdown of ICC functions.

6.5.2.3.8.3 Performance Monitoring

ICC-6080 The ICC shall provide the capability to analyze **and report** its internal performance at a minimum for the following:

a. CPU utilization

b. ~~Data~~ **Processing** throughput for plans and schedules, DARs, and commands

c. Equipment downtime

d. Mass storage utilization

e. Communication resource utilization

f. Data accounting

ICC-6090 The ICC shall alert the operator when its status changes or when data errors exceed operator-specified levels.

6.5.2.3.8.4 Fault Management

ICC-6110 The ICC shall manage its faults, including at a minimum the following:

a. Fault identification

b. Identification of recommended solutions

c. Log of fault activities through resolution

ICC-6120 The ICC shall analyze **and report** the configuration, status, accounting, and performance information received from ICC components.

ICC-6130 The ICC shall be capable of initiating diagnostics to aid in isolating internal faults, using safeguards to prevent their operations from affecting other operations.

ICC-6135 The ICC shall ~~participate in the resolution of~~ **identify and report** failures and anomalies involving the interfaces of the ICC.

6.5.2.3.8.5 Operations Testing

ICC-6140 The ICC shall provide tests for validating, verifying, and checking functional capabilities and performance for ICC functions after the ICC has been repaired or upgraded.

ICC-6145 The ICC shall provide standard test data sets to be used in the validation of the ICC functions.

ICC-6150 The ICC shall provide the capability to support the instrument integration test activities associated with the instrument testing, spacecraft and instrument integration testing, and launch site testing.

ICC-6195 The ICC shall provide the capabilities:

a. To test both nominal operations and failure paths

b. To log test activities **and configuration**

c. To support analysis of test data and the generation of test results

d. To maintain test procedures~~, test configuration,~~ and test results

6.5.2.3.8.6 Report Generation

ICC-6200 The ICC shall provide capabilities to generate at a minimum the following:

a. Security audit log

b. ICC resource utilization report

c. ICC status report

d. ICC hardware/software configuration history

ICC-6205 The ICC status report shall include at a minimum the following:

a. DAR statistics

b. Compliance with LTIP

c. Anomaly reports

d. Maintenance reports

ICC-6210 The ICC shall provide the SMC and the EOC with access to ICC reports.

6.5.2.3.9 User Interface Service

ICC-6510 The ICC shall provide the capability for the operator to control the ICC functions and components, utilizing a combination of input devices ~~and styles, as appropriate~~.

ICC-6520 The ICC shall provide the capability for the operator to ~~output spacecraft, instrument,~~ **send to displays, printers, and files spacecraft, instrument,** and ground system information used or generated by each ICC function~~, to displays, printers, and files~~.

ICC-6525 The ICC shall provide the capability to notify the operator of events and alarms.

ICC-6540 The ICC shall support the use of a high-level interactive control language, which consists of a set of directives and programming-like language capabilities, including at a minimum the following:

a. Evaluate algebraic and logical expressions

b. Exercise decision logic (IF statements)

c. Automated execution of a set of multiple directives (i.e., user interface language procedure)

d. Internally branch to other parts of the user interface language procedure

e. Nest user interface language procedures within procedures

f. Initiate other ICC applications

ICC-6580 The ICC shall provide the operator with the capability to create, modify, and delete user interface language procedures.

ICC-6590 The ICC shall provide the capability for the operator to define the format and contents of text and graphics displays.

ICC-6600 The ICC shall respond to user inputs within 0.5 seconds.

ICC-6620 The ICC shall be capable of updating displays of rapidly changing information (~~e.g.,~~ **i.e.,** telemetry data) at rates of up to once per second.

6.5.2.3.10 IST

ICC-7010 The IST shall have the capability to accept from the ICC and display, in parallel with any current activities in the IST, a notification regarding at a minimum the following:

a. Conflicts found in planning and scheduling

b. Arrival of instrument engineering data

c. Arrival of quick-look data

d. Instrument anomalies found during instrument monitoring

ICC-7030 The IST shall have the capability to accept the requested data from the ICC in parallel with any current activities in the IST.

ICC-7050 The IST shall have the capability to provide the ICC with updates to the IDB.

ICC-7060 The IST shall have the capability to ~~ingest data~~ **accept data** from ~~the IST~~ **a non-ECS provided system** that supports **the** PI/TL instrument operations, which include at a minimum **the following data**:

a. Microprocessor memory loads

b. Changes in the instrument parameters

ICC-7070 The IST shall have the capability to provide **data to a non-ECS provided system** ~~data to the ISTs~~ that support **the** PI/TL instrument operations, which include at a minimum **the following data**:

a. Microprocessor memory dumps

b. Instrument analysis results

6.5.2.3.10.1 DAR Processing Support

ICC-7110 The IST shall provide the capability ~~for the TL or instrument PI~~ to communicate with a DAR originator(s) for modification and for clarification of DARs.

ICC-7150 The IST shall provide the capability ~~for the TL or instrument PI~~ to generate and submit DARs to the IMS.

ICC-7170 The IST shall receive from the IMS status of the DARs generated at the IST.

ICC-7180 The IST shall have the capability to accept from the ICC a DAR evaluation request along with the corresponding DAR.

ICC-7190 The IST shall provide the capability ~~for the TL or instrument PI~~ to view and modify the DARs received from the ICC.

ICC-7200 The IST shall provide the ICC with either DAR acceptance notification with updates, if any, or DAR rejection notification along with the reasons for rejection.

6.5.2.3.10.2 Planning and Scheduling Support

ICC-7210 The IST shall provide the capability ~~for the TL or instrument PI~~ to ~~generate an ISAR~~ **request an instrument activity and submit it to the ICC.**

~~ICC-7212 The IST shall interface with the ICC to submit an ISAR.~~

DELETED -- Subsumed by ICC-7210.

ICC-7214 The IST shall interface with the ICC to receive notification of ~~ISAR~~ **request for instrument support activity** receipt.

ICC-7220 The IST shall have the capability to request and accept from the ICC planning and scheduling information, which includes, at a minimum, the following:

a. LTSP **and LTIP** ~~goals and priorities~~

b. Current resource availability information

c. Current predicted orbit data and related information

d. Plans and schedules

ICC-7230 The IST shall have the capability to access planning and scheduling functions in the ICC ~~or EOC (via ICC)~~.

ICC-7240 The IST shall accept from the ICC a request for resolving conflicts identified at the ICC while building or updating plans or schedules for its instrument.

ICC-7250 The IST shall provide the capability ~~for the TL or instrument PI~~ to view and evaluate the requests for resolving problems of the instrument plans and schedules.

ICC-7270 The IST shall provide the ICC with the results of evaluating the plans and schedules (in response to the conflict resolution requests from the ICC).

6.5.2.3.10.3 Instrument Commanding Support

ICC-7290 The IST shall have the capability to request and accept from the ICC at a minimum the following:

a. Current ~~CFS~~ **detailed activity schedule**

b. Instrument commands and memory loads

c. Instrument command status

ICC-7330 The IST shall provide the capability ~~for the TL or instrument PI~~ to review instrument commands.

ICC-7350 The IST shall provide the capability ~~for the TL or instrument PI~~ to generate and display a command request.

ICC-7360 The IST shall have the capability to provide a command request to the ICC.

ICC-7370 The IST shall have the capability to accept from the ICC command request status, which contains at a minimum the following:

a. Receipt of the command request at the ICC

b. Receipt of the commands at the EOC

c. Status of command transmission to the spacecraft

d. Receipt of the commands at the spacecraft

e. Execution of the commands at the instrument

ICC-7390 The IST shall have the capability to send instrument microprocessor memory loads to the ICC.

ICC-7400 In support of a TOO observation **or a late change**, the IST shall ~~be capable of retrieving and completing~~ **provide** the corresponding command request ~~and forwarding it~~ to the ICC within 10 minutes of receiving initiation notification ~~from the TL or instrument PI~~.

~~ICC-7410 In support of a critical instrument support activity, the IST shall be capable of retrieving and completing the corresponding command request and forwarding it to the ICC within 10 minutes of receiving initiation notification from the TL or instrument PI.~~

DELETED -- Subsumed by ICC-7400.

6.5.2.3.10.4 Instrument Monitoring Support

ICC-7430 The IST shall have the capability to request and accept from the ICC at a minimum the following:

a. Instrument housekeeping and engineering data

b. Spacecraft housekeeping data

c. Derived parameters for its instrument

d. Quick-look data

e. Instrument performance assessment data

ICC-7460 The IST shall **support** ~~provide~~ the capability ~~for the TL or instrument PI~~ to display and process ~~extract any subset of~~ the raw or engineering unit converted instrument engineering data ~~for display and subsequent processing~~.

ICC-7500 The IST shall have the capability to analyze instrument housekeeping and engineering data to determine the instrument trend.

ICC-7510 The IST shall have the capability to access any data in the ICC history log.

ICC-7530 The IST shall have the capability to display quick-look data.

ICC-7550 The IST shall provide the capability ~~for the TL or instrument PI~~ to notify the ICC of any instrument anomalies detected.

6.5.2.4 ICC Performance

ICC-8010 The ICC shall be capable of supporting the following simultaneous activities:

a. Performing mission coordination, planning, scheduling, monitoring, and commanding of its instruments.

b. At least two of the following: mission test activities, ICC system upgrades, training, and/or maintenance.

ICC-8020 The ICC computer hardware shall be able to grow without redesign to twice the processing, storage, and communications capacities estimated for full system operation.

ICC-8040 The ICC computer processing, storage, and communications capacity utilization shall be less than 50 percent at turnover for operations.

ICC-8050 The GSFC ~~ICF~~ ICC architecture shall be capable of growing to support additional instruments without major redesign.

ICC-8060 The ICC design shall include hooks to support additional U.S. instruments without major redesign.

7. Science Data Processing Segment (SDPS)

7.1 Overview

The Science Data Processing Segment (SDPS) has the responsibility to meet the objectives of the EOS mission in instrument data acquisition planning, data product search and ordering, processing, archiving, and distribution. The SDPS produces Standard Products, including quick-look products and browse products such as subsetted, subsampled, and summarized data sets, as well as the associated metadata. These products are created during routine production processing and on demand in response to user requests. The SDPS controls data quality to meet all authorized scientists needs, supports the integration and testing of algorithms and associated software, stores all data sets and supports software for the duration of the mission, and provides user access to data and related information. The term "algorithm" refers to software delivered to the SDPS by a science investigator (PI, TL, or II) to be used as the primary tool in the generation of science products. This incorporates executable code, source code, job control scripts, as well as documentation. The SDPS also provides software toolkits to the EOSDIS users. These toolkits provide an integrated package of toolkit routines provided by the ECS elements that provide a wide range of common user services including data visualization tools, data transformation tools, data access services, and algorithm development resources.

7.2 SDPS Architecture

The SDPS consists of the ~~Distributed Active Archive Centers (DAACs) and~~ **Product Generation System (PGS), the Data Archiving and Distribution System (DADS), and** the Information Management System (IMS). ~~Each DAAC is composed of the Product Generation System (PGS) and the Data Archiving and Distribution System (DADS).~~ The ~~DAAC~~ **SDPS** has an overall responsibility in coordinating the scheduling and data storage for science data processing, archiving and distribution between its local PGS and DADS and other ECS sites ~~DAACs~~. The ~~DAAC~~ **SDPS** is also responsible for interfacing with the Communications and System Management Segment (CSMS) for resolving any data communications and delivery scheduling conflict~~ through the IMS~~. The IMS is the user interface to ECS and provides facilities for identifying and requesting desired data products from the ECS to the user. The distributed IMS will be hosted at the ECS sites ~~DAACs~~. However, the IMS will function as a single integrated system from the point of view of the user. The ~~DAAC~~ **PGS and DADS** interfaces with the IMS for coordinating data product ordering, metadata and document transfer, and distribution scheduling activities. The ~~DAAC~~ **PGS and DADS** exchanges product status with the IMS and the SMC. The ~~DAAC~~ **PGS and DADS** also provides the necessary metadata and documentation to the IMS for interpreting the requested data products.

The SDPS interfaces with the Flight Operations Segment (FOS) in order to support planning in response to Data Acquisition Requests (DARs) and to ensure the quality of received data through the use of spacecraft and instrument status information, and mission historical data. The SDPS also interfaces with the CSMS for maintaining the segment system configuration and network communications, and for receiving directives on policy, priorities, and procedures, including the final resolution of operational schedule conflicts. The SDPS interfaces externally with EDOS and the IPs for acquiring Level 0 data, quick-look data, and ancillary data. The SDPS also interfaces externally with the Flight Dynamics Facility (FDF) for receiving **predictive and** refined or repaired orbit and attitude data, and the EPDSs to receive Earth Probe data products and metadata. In addition, it provides facilities for delivering data products and the associated subsetted, subsampled, and summarized data sets and metadata to PIs and other science users and exchanging data products and metadata with the PIs, ADCs, and ODCs.

7.2.1 SDPS Context View

A conceptual context diagram illustrating the relationships between the SDPS and the other two ECS segments, the EDOS, the FDF, the SCFs, the science users, the IPs, the EPDSs, the ADCs, and the ODCs is given in Figure ~~7.2.1-1~~ **7-1**.

The SDPS receives and processes Level 0 data, quick-look data, and ancillary data transmitted from the EDOS, **Pacor,** and the IPs, and distributes the EOS data products and associated metadata to the PIs and other science users for quality check, and scientific analysis and applications. The SDPS provides the FOS with quick-look products for further assessment of the status of instrument operations and quality of received data. The SDPS receives the flight operations and spacecraft status from the FOS to assist in determining the quality of received data. The SDPS provides the CSMS with resources and operations status information and schedules. The SDPS receives directives on priorities and policy, including schedule conflict resolutions from the CSMS.

The SDPS interfaces with the SCFs to perform data quality assessment, to receive updated algorithms and coordinate their test and integration into the production environment, and to exchange special and standard products. In addition, the SDPS provides users the capability to identify and select their desired information and data products before ordering, delivers the requested products to users, and receives back from users research results and new derived data sets. The SDPS also receives **predictive and** refined or repaired orbit and attitude data from FDF for instrument data processing and calibration purposes.

The SDPS interfaces with the EPDSs, the ADCs, the ODCs, **the TRMM Processing Facility (TSDIS),** and the IPs for exchanging data products, metadata, correlative data, ancillary data, and algorithms information.

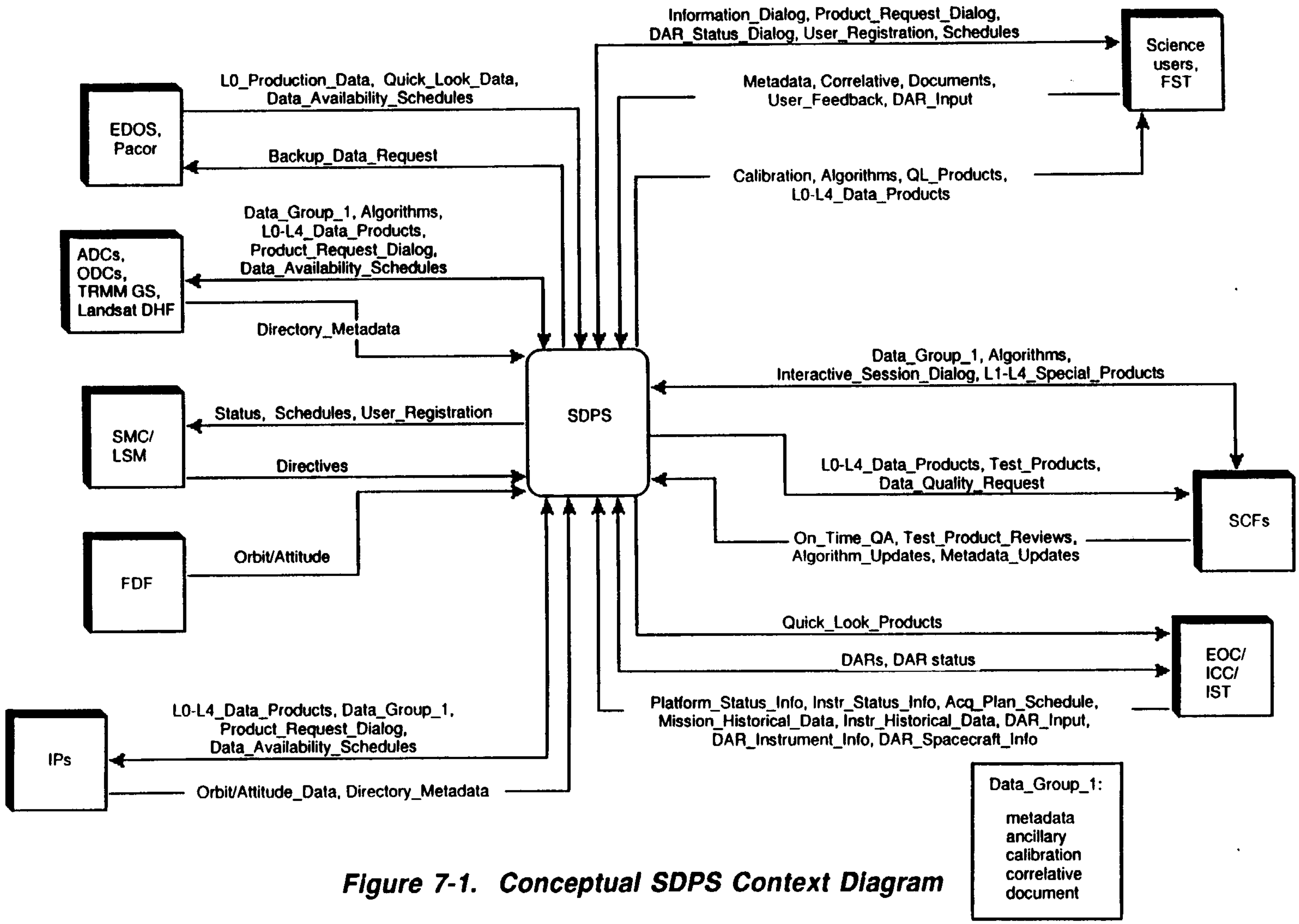


Figure 7-1. Conceptual SDPS Context Diagram

7.2.2 SDPS Physical View

The SDPS physical architecture illustrating the proposed location of **each ECS site with the corresponding** ~~DAACs~~ **PGS, DADS,** and IMS is shown in Figure ~~7.2.2-1~~ **7-2**. The IMS will provide the capability to allow the EOS users, ADCs, ODCs, and IPs to search, identify and retrieve their desired information and data products, and to deposit EOS and non-EOS data products, ancillary data, correlative data, metadata, and documentation in the EOSDIS. The proposed ~~DAACs~~ **ECS sites** will be located at Goddard Space Flight Center (GSFC), Marshall Space Flight Center (MSFC), Langley Research Center (LaRC), Jet Propulsion Laboratory (JPL), EROS Data Center (EDC), Alaska SAR Facility (ASF), National Snow and Ice Data Center (NSIDC), and Oak Ridge National Laboratory (ORNL).

7.3 Operational View

The SDPS segment is made up of ~~two~~ **three** elements: the IMS**, the PGS, and the DADS**~~and the DAAC~~.

The distributed IMS is the SDPS interface to the system for users and manages and provides metadata and supporting information as well as product order and processing status to allow users to select and order data products and support information as required. The metadata that describes the tens of thousands of data granules generated per day is produced as adjunct processing during standard product generation and is used to populate the IMS's metadata databases. The primary means for building and maintaining the catalogs is automated; however, occasional updates will occur manually by authorized users. The IMS provides a capability for users to search through the metadata databases and determine if an order should be placed for the desired data.

The ~~DAAC is~~ **PGS and the DADS are** responsible for all data product generation, reprocessing, algorithm integration-related activities, data archiving, storage, and distribution. The ~~DAAC~~ **PGS and the DADS** also hosts some functions of the distributed IMS. The ~~DAAC~~ **PGS and the DADS** will provide software tools to the EOS users to assist in simulating the operation of their algorithms in the production environment and to perform data set transformations.~~This element is made up of two components: the PGS and the DADS.~~ The PGS performs data product generation and reprocessing, and is responsible for the overall data product generation planning. The DADS provides staging capability to the PGS as well as long term archive mass storage and data distribution.

7.4 SDPS Requirements

The SDPS requirements are developed and presented in functional, performance, and interface areas.

SDPS0010 The SDPS shall provide CSMS with operational, data processing, data quality and accounting status.

SDPS0015 The ~~**DAAC**~~ **SDPS** shall receive directives on priorities and policy, including schedule conflict resolutions, from the SMC.

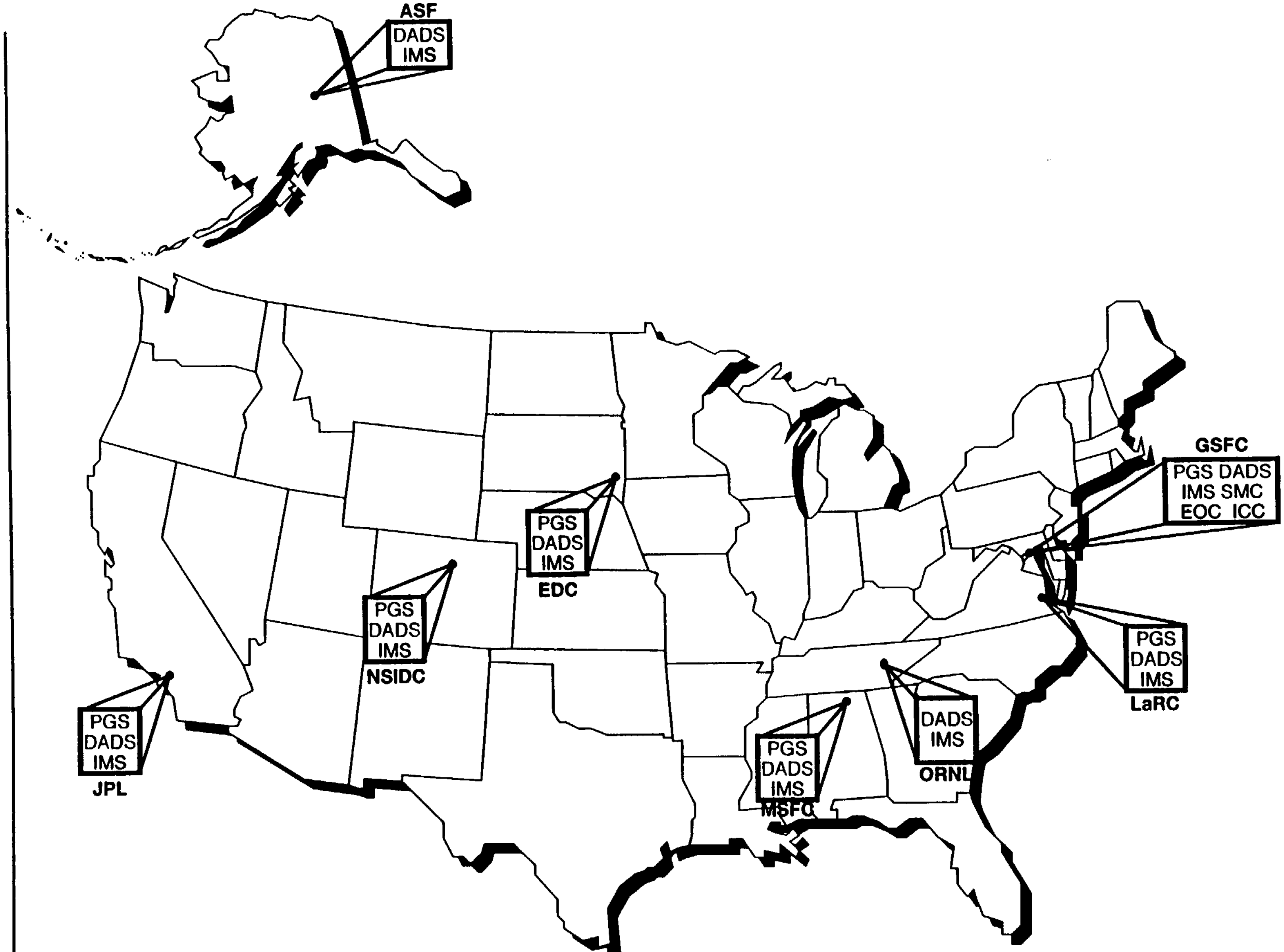


Figure 7-2 SDPS Physical Architecture

MOVED -- Moved from DAAC0160.

SDPS0020 The SDPS shall receive EOS science, engineering, ancillary, and quick-look data from the EDOS, **the Pacor,** and the IPs, and non-EOS data, **in situ data, algorithms, documentation,** correlative data, and ancillary data (**as listed in Appendix C**) from ADCs, EPDSs, and ODCs.

SDPS0030 The SDPS shall produce Standard Products (~~including~~ **as listed in Appendix C, including** prototype products on a time-available basis) for EOS instruments based on the algorithms source code and calibration coefficients supplied by EOS scientists.

SDPS0031 The ~~DAAC~~ **SDPS** shall generate browse data and metadata for routing to the ~~requested~~ requesting users~~, through the coordination of IMS~~.

MOVED -- Moved from DAAC0220.

SDPS0035 The SDPS shall produce derived ancillary products as Standard Products for EOS investigators based on algorithms and coefficients for conversion, calibration, and transformation of selected engineering/housekeeping data parameters.

SDPS0040 The SDPS shall generate quick-look products for use by the operational staff residing at ICCs, the PIs, and other science users.

SDPS0050 The SDPS shall archive, manage, quality check, and account for the generated data products, and distribute the data products to the appropriate destinations as required.

SDPS0080 The SDPS shall archive, manage, quality check, and account for all science and ancillary data received from the IPs, the EPDSs, the SCFs, the ADCs, the ODCs, **other ECS sites, PIs** and the other EOS science users.

SDPS0090 The SDPS shall interface with the PIs and the other science users to support the development **and testing** of data product algorithms and QA of produced data products.

SDPS0091 The ~~DAAC~~ **SDPS** shall receive a quality report that is generated and transmitted by the PIs or the other science users, and appended to the data products being archived by the ~~DAAC~~ **SDPS.**

MOVED -- Moved from DAAC0092.

SDPS0092 The SDPS shall support science user development of new search techniques that dynamically browse the data and metadata.

SDPS0093 The SDPS shall permit general science user access to these new search techniques but limit system resource usage to 10% of the information management data processing, archiving, and distribution resources otherwise used for production and distribution of Level 2 and Level 3 products.

Note: **It is assumed that new search techniques will be developed and installed by means of components separate from the ECS. All requests for data or services by the new search techniques are assumed to be already factored into the existing ECS request load described in this specification.**

SDPS0095 The SDPS shall provide science user interfaces that are individually tailorable including settable preferences, user defined keywords, query save capabilities, and screen layout preferences.

SDPS0100 The SDPS shall be responsible for delivery of EOS data and data products to the IPs, the ADCs, the ODCs, and the other science users via EOSDIS networks and on a variety of physical media.

SDPS0110 The SDPS shall be responsible for coordination of the transfer of production and quick-look science and engineering data from EDOS, **Pacor, and the IPs.**

SDPS0115 The ~~DAAC~~ **SDPS** shall accept notification of the possible future availability of out-of-sequence data by the EDOS and shall schedule processing accordingly.

MOVED -- Moved from DAAC0330.

SDPS0120 The SDPS shall be capable of operating in a 24-hour a day, 7-day a week mode.

SDPS0130 Each DAAC shall interface with all other DAACs for exchanging data products, browse data, metadata, data quality information, research results, and documentation.

MOVED -- Moved from DAAC0120.

SDPS0140 The ~~DAAC~~ **SDPS** shall support element, system, and subsystem test activities throughout the development phase.

MOVED -- Moved from DAAC0250.

SDPS0150 The ~~DAAC~~ **SDPS** shall have the capability of generating quick-look products within 6 hours of receipt of the necessary input data for 10% of the EOS instrument data requiring processing capacity of no more than 10% of the processing requirement for the equivalent standard product.

MOVED -- Moved from DAAC0262.

SDPS0160 The ~~DAAC~~ **SDPS** shall have the capability of generating quick-look products within 1 hour of receipt of the necessary input data for 1% of the EOS instrument data requiring processing capacity of no more than 1% of the processing requirement for the equivalent standard product.

MOVED -- Moved from DAAC0264.

SDPS0170 The ~~DAAC~~ **SDPS** shall accommodate growth in the instrument processing load and storage capacity without changes to the ~~DAAC~~ **SDPS** architecture or design.

MOVED -- Moved from DAAC0290.

7.5 SDPS Elements

The SDPS consists of ~~two~~ **three** elements: the ~~DAAC~~ **PGS, the DADS,** and the IMS.~~—The DAAC is composed of two sub-elements: the PGS and the DADS.~~

~~The DAAC receives directives on policies, priorities and procedures, including schedule conflict resolutions from the SMC. The DAAC receives and processes Level 0 data, quick-look data and ancillary data transmitted from the EDOS and the IPs. The DAAC interfaces with the IPs, the EPDSs, the ADCs, the ODCs, and other DAACs for exchanging EOS and non-EOS data products, metadata, ancillary data, correlative data, and algorithms or algorithm documentation for data product generation and distribution as established through the IMS. The DAAC communicates with the EOSDIS external systems through the services of ESN. The DAAC interfaces with the PIs and the other science users for data quality assessment, algorithm updates, special data products generation, and test product reviews.~~

~~7.5.1.3 DAAC Operations~~

~~The DAAC performs overall planning and scheduling of data ingest, data storage, internal networking, and the external interfaces for science data processing, reprocessing, archiving, and distribution. When scheduling conflicts occur, they will be resolved, if possible, by coordination between the DAAC and the IMS. Otherwise, the SMC will provide a final resolution.~~

~~7.5.1.4 DAAC Requirements~~

~~The DAAC requirements are developed and presented in functional, performance, and interface areas.~~

~~DAAC0010 The DAAC shall receive EOS Level 0 data, ancillary data, and quick-look data from EDOS and the FDF for EOS routine processing and reprocessing.~~

DELETED -- Subsumed by SDPS0020.

~~DAAC0020 The DAAC shall provide the SMC with the current operations, processing, data quality, and accounting status.~~

DELETED -- Subsumed by SDPS0010.

~~DAAC0030 The DAAC shall ingest production science and engineering data from the EDOS, some EPDSs, and the IPs and receive special data products, algorithms, research results, and derived data sets from the PIs and other science users.~~

DELETED -- Subsumed by SDPS0020, SDPS0050, and SDPS0080.

~~DAAC0040 The DAAC shall be responsible for the coordination of the transfer of production science and engineering data from the EDOS and the IPs.~~

THIS DIAGRAM HAS BEEN DELETED

Figure 7.5.1.2-1. Conceptual DAAC Context Diagram

DELETED -- Subsumed by SDPS0110.

~~DAAC0060 The DAAC shall provide the science users, the ADCs, the ODCs, and the IPs with data products, metadata and browse data on a request basis, through the coordination of IMS.~~

DELETED -- Subsumed by SDPS0100.

~~DAAC0070 The DAAC shall generate Level 1, 2, 3 and 4 data products, archive, manage, quality check, and account for archived data products.~~

DELETED -- Subsumed by SDPS0030 and SDPS0050.

~~DAAC0072 The DAAC shall distribute data products and special data products to the appropriate destinations as established through the IMS.~~

DELETED -- Subsumed by SDPS0050 and SDPS0100.

~~DAAC0080 The DAAC shall receive product status requests and product orders from the IMS for identifying, reporting and distributing the requested data products as required.~~

DELETED -- Subsumed by SDPS0050.

~~DAAC0092 The DAAC shall receive a quality report that is generated and transmitted by the PIs or the other science users, and appended to the data products being archived by the DAAC.~~

MOVED -- Moved to SDPS0091.

~~DAAC0100 The DAAC shall transmit data quality information, data products, correlative data, metadata, browse data, and test products to the PIs or other science users.~~

DELETED -- Subsumed by SDPS0100.

~~DAAC0110 The DAAC shall interface with the SCFs to support the development of data product algorithms and QA of data products.~~

DELETED -- Subsumed by SDPS 0090.

~~DAAC0120 Each DAAC shall interface with all other DAACs for exchanging data products, browse data, metadata, data quality information, research results, and documentation.~~

MOVED -- Moved to SDPS0130.

~~DAAC0130 The DAAC shall receive approved data products, ancillary data, correlative data, in-situ data, algorithms and documentation from ODCs for the generation and validation of higher level data products and supporting metadata.~~

DELETED -- Subsumed by SDPS0020.

~~DAAC0150 The DAAC shall store approved data products, metadata, browse data, data quality and accounting information, documentation, and algorithms received from the PIs and the other science users, the IPs, other DAACs, the EPDSs, the ADCs, and the ODCs.~~

DELETED -- Subsumed by SDPS0080.

~~DAAC0160 The DAAC shall receive directives on priorities and policy, including schedule conflict resolutions, from the SMC.~~

MOVED -- Moved to SDPS0015.

~~DAAC0220 The DAAC shall generate browse data and metadata for routing to the requested users, through the coordination of IMS.~~

MOVED -- Moved to SDPS0031.

~~DAAC0250 The DAAC shall support element, system, and subsystem test activities throughout the development phase.~~

MOVED -- Moved to SDPS00140.

~~DAAC0260 The DAAC shall produce quick-look products for priority transfer to the ICCs, FSTs, and other users.~~

DELETED -- Subsumed by SDPS0040.

~~DAAC0262 The DAAC shall have the capability of generating quick-look products within 6 hours of receipt of the necessary input data for 10% of the EOS instrument data.~~

MOVED -- Moved to SDPS0150.

~~DAAC0264 The DAAC shall have the capability of generating quick-look products within 1 hour of receipt of the necessary input data for 1% of the EOS instrument data.~~

MOVED -- Moved to SDPS0160.

~~DAAC0270 The DAAC shall be capable of operating 24 hours a day, 7 days a week.~~

DELETED -- Subsumed by SDPS0120.

~~DAAC0290 The DAAC shall accommodate growth in the instrument processing load and storage capacity without changes to the DAAC architecture or design.~~

MOVED -- Moved to SDPS0170.

~~DAAC0300 The DAAC shall follow the processing schedules to produce Standard Products, along with their associated browse data and metadata.~~

DELETED -- Subsumed by SDPS0030 and SDPS0031.

~~DAAC0310 The DAAC shall provide the PIs and the other science users with the updated metadata for the assessment of data product quality.~~

DELETED -- Subsumed by SDPS0090.

~~DAAC0320 The DAAC shall support testing of science algorithms.~~

DELETED -- Subsumed by SDPS0090.

~~DAAC0330 The DAAC shall accept notification of the possible future availability of out-of-sequence data by the EDOS and shall schedule processing accordingly.~~

MOVED -- Moved to SDPS0115.

~~7.5.1.5 DAAC Subelements~~

~~A DAAC consists of a closely coupled PGS and DADS. The PGS is a product generation facility which executes science algorithms to generate Standard Products from EOS instrument data, and other relevant data and information. The DADS is a data archiving and distribution facility which archives EOS and non-EOS data and data products, and distributes them per request via networks or on a variety of physical media.~~

7.5.1.5.1 Product Generation System (PGS)

7.5.1.5.1.1 Overview

The Product Generation System (PGS) is a production oriented computing facility which executes scientist-developed algorithms to generate Standard Products from instrument data and other data. Standard Products include Level 1 through Level 4 data products, and quick-look products. These products are then stored in the DADS for general access by scientists and other users of the EOSDIS system (quick-look products are also delivered to the ICC and field campaign users). The PGS produces metadata to facilitate selection of Standard Products from archival holdings and interpretation of the products. It generates data quality assessment profiles for each Standard Product in coordination with the scientists. It reprocesses large portions of data sets to provide a consistent, long-term database that meets high standards of scientific quality.

The PGS accepts new algorithms from scientists to produce additional Standard Products, and modifications to existing algorithms in response to changing scientific evaluation results. As part of the algorithm life-cycle, some algorithms may be run for a time in a mode where routine generation is not guaranteed, producing prototype products which are treated in all other respects by the SDPS as Standard Products.

7.5.1.5.1.2 PGS Conceptual Architecture

The PGS is the element of the SDPS that is responsible for the production of the science products that will be used by the science community to fulfill the science objectives of the EOS mission. Several PGSs will be established, each with an associated (co-located) DADS, at various sites across the U.S. as shown in Figure ~~7.2.2-1~~ **7-2.**

The PGS maintains operational and support data flows with the IMS through the ESN.

7.5.1.5.1.2.1 PGS Interfaces

Figure ~~7.5.1.5.1.2.1-1~~ **7-3** illustrates the interfaces between the PGS and other EOSDIS elements as well as between the PGS and non-EOSDIS elements. The primary interface is with the associated DADS. The DADS provides all input data files necessary to meet the production schedule, including Level 0 through Level 4 data sets (either residing at the local DADS, or received by the local DADS from remote DADS) and ancillary data. The DADS provides storage for any algorithms and calibration data that the PGS does not hold on a regular basis. The DADS routes Level 0 data identified as quick-look or priority processing data to the PGS. The DADS receives and responds to requests for the staging of stored data. The DADS receives and stores generated Level 1 to Level 4 Standard Products, as well as the associated metadata. The DADS receives the results of quick-look processing for priority transfer to destinations such as the ICCs. **The PGS also interfaces with Pacor for the receipt of Level 0 TRMM data.**

The IMS provides the PGS with processing requests from the science community. These include standing orders for Standard Products that will be generated on a regularly-scheduled basis and specific requests for other Standard Products. The PGS reports schedule conflicts to the ~~IMS~~ **SMC**. Copies of the PGSs' processing schedules are provided to the IMS to allow users to project the status of their requests.

The PGS sends regular status reports and copies of the PGS schedules to the SMC. The SMC delivers operational directives including priority assignments and resolution of schedule conflicts not resolved by iteration with the IMS.

The PGS supports the integration of new and updated science algorithms into the production environment through an interactive link to the scientists located at the SCFs. The SCFs transmit new or revised algorithms along with associated documentation and test data to the PGS. Test products generated by the candidate algorithms are sent to the SCF. Reviews of the test products are sent to the PGS. The PGS also sends requests for scientists to assess the data quality of its products and receives the resulting quality assessments. All algorithms will be placed under software configuration control.

The PGS also receives data availability schedules ~~from~~ **for** remote DADS, EDOS, the IPs, the ADCs, the EPDSs, and ODCs **from the DADS.**

7.5.1.5.1.2.2 Data Flows

Data flows across each interface are identified in Figure ~~7.5.1.5.1.2.1-1~~ **7-3. Table 7-1 lists and describes the data flows between the PGS and other EOSDIS and non-EOSDIS elements.**

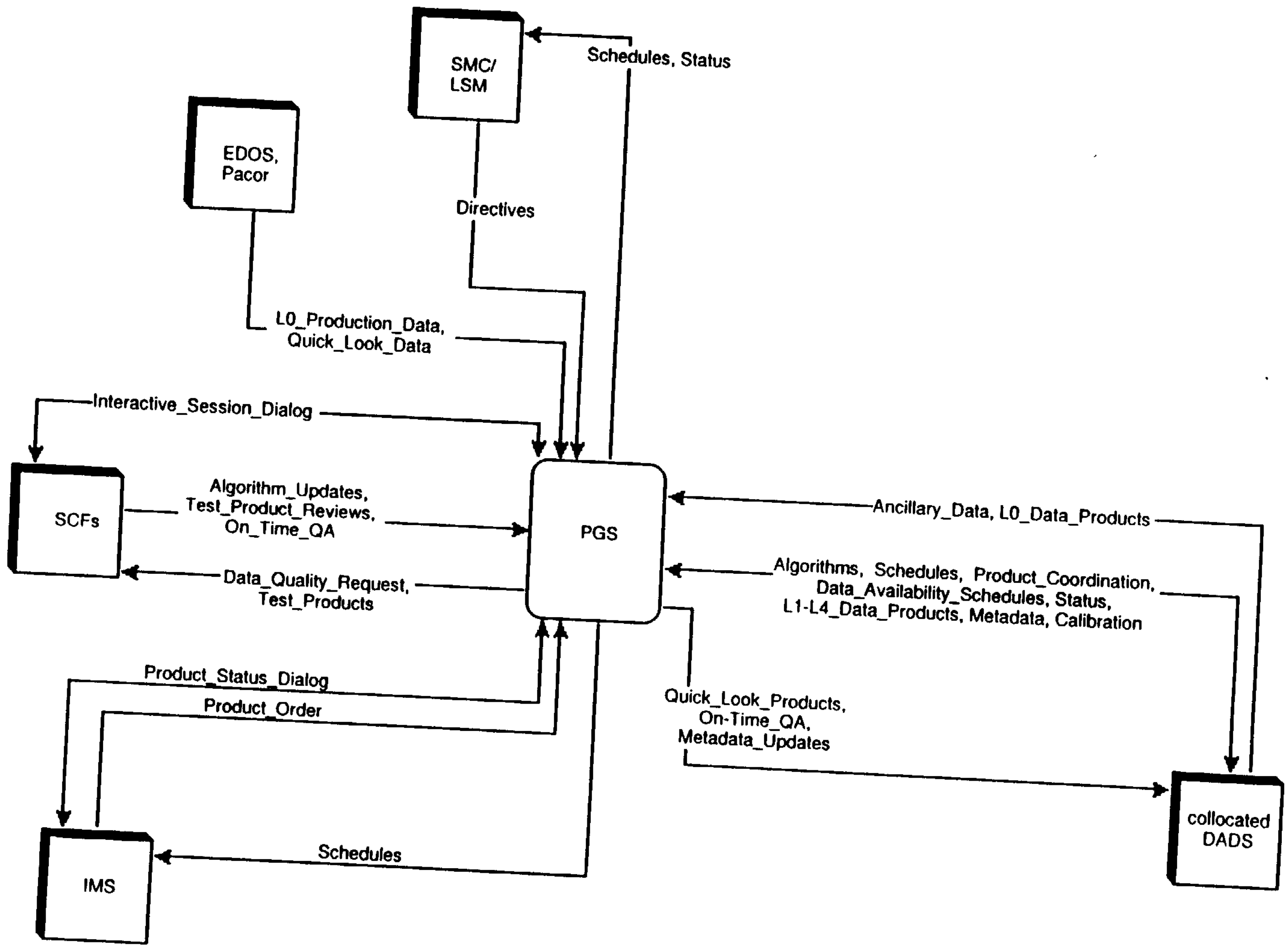


Figure 7-3. Conceptual PGS Context Diagram

Table 7-1. Conceptual PGS Data Flows (1 of 4)

From	To	Data Item	Description
DADS PGS	PGS DADS	Algorithms	Algorithms consist of the executable programs for science product generation, source code of these executable programs, job control scripts, and algorithm documentation. Algorithms are the result of a new or updated science algorithm passing through the integration and test process, involving the scientist and the PGS's algorithm integration and test staff. After formal approval, algorithms are delivered by the PGS to the DADS for storage, and are retrieved as needed to support product production. Some frequently used algorithms may be kept on line in the PGS.
SCF	PGS	Algorithm Updates	Algorithm Updates are delivered to the PGS's integration and test environment by scientists at an SCF. They represent changes to existing production algorithms, or a new algorithm to produce a new Standard Product. Algorithm updates include the source code for the candidate algorithm, its associated documentation, and a job step control skeleton. The source code will be compiled to form an executable program suite as part of the integration and test process. The job step control skeleton contains instructions that control the sequence of execution of, and the interchange of data between programs from the executable program suite. Test data sets and calibration data should also be included.
DADS	PGS	Ancillary Data	Ancillary Data refers to any data, other than Standard Products, that are required as input in the generation of a Standard Product. This may include selected engineering data from the EOS spacecraft, as well as non-EOS ancillary data.
DADS PGS	PGS DADS	Calibration	Calibration is the collection of data required to perform calibration of the instrument science data, instrument engineering data, and the spacecraft engineering data. It includes pre-flight calibration measurements, in-flight calibrator measurements, calibration equation coefficients derived from calibration software routines, and ground truth data that are to be used in the data calibration processing routine.

Table 7-1. Conceptual PGS Data Flows (2 of 4)

From	To	Data Item	Description
DADS PGS	PGS DADS	Data Availability Schedules	Data Availability Schedule is a schedule indicating the times at which specific data sets will be available from remote DADS, EDOS, Pacor, Landsat, the IPs, the ADCs and ODCs for ingestion by the collocated DADS. The schedules are received directly by the DADS and provided to the PGS. The PGS provides its collocated DADS with data availability schedules for distribution to remote DADS.
PGS	SCF	Data Quality Request	Data Quality Request is a request issued by the PGS to a scientist at an SCF to perform QA of a particular product. A time window is applied to the request in keeping with the production schedule.
SCF PGS	PGS SCF	Interactive Session Dialog	Interactive Session Dialog consists of messages that flow between a scientist at an SCF and the PGS that support general communication with the Integration and Test Service. This includes logins, mail messages, etc.
DADS	PGS	L0 Data Products	L0 Data Products consist of L0 Data Products from the IPs, the ADCs and ODCs.
EDOS Pacor	PGS PGS	L0 Production Data	L0 Production Data is the result of L0 processing by EDOS and Pacor on the raw science and engineering data from a spacecraft. It is data that is time-ordered, with overlaps removed. It is routed to the PGS from EDOS or Pacor by the DADS.
DADS PGS	PGS DADS	L1-L4 Data Products	L1-L4 Data Products consist orf Level 1 through Level 4 data products generated by the PGS and stored by the collocated DADS. The L1-L4 Data Products may be obtained by the PGS from the collocated DADS. These represent the primary input to the product generation process.
DADS PGS	PGS DADS	Metadata	Metadata is data which describes a Standard Product including standard metadata (i.e., algorithm and calibration number, size of product, date created, etc.), algorithm-derived metadata, QA information from the PI's, summary statistics and an audit trail.

Table 7-1. Conceptual PGS Data Flows (3 of 4)

From	To	Data Item	Description
PGS	DADS	Metadata Updates	Updates to Standard Product Metadata QA information.
SCF PGS	PGS DADS	On-Time QA	On Time QA is a response to a data quality request that is received within the established production time window. It is received from a scientist at an SCF. It consists of data which will be used to complete the QA fields of the metadata. Overdue QA responses are sent directly to the DADS.
DADS PGS	PGS DADS	Product Coordination	Product Coordination is the coordination of the receipt, staging, and storage of data necessary to carry out the PGS processing schedule.
IMS	PGS	Product Orders	Product Order is either a request for the generation of a specific product with an associated time window, a priority processing request, a reprocessing request, or a standing order for a product to be generated on a regular basis with a rough timeline, or changes to standing orders. Product orders are received by the PGS from the IMS.
IMS	PGS	Product Status Dialog	A request for the status of product processing or distribution.
PGS	IMS	Product Status Dialog	Current status of product processing or distribution. If anytime during the processing of an order, it becomes clear that the order will not be satisfied within the estimated time window, then the PGS or DADS will notify the IMS and the IMS will notify the requestor.
EDOS Pacor	PGS PGS	Quick Look Data	Quick Look Data are data received during one TDRSS contact period which have been processed to Level 0 (to the extent possible for data from a single contact). These are data that have been identified as requiring priority processing on the order of a few hours. They are routed to the PGS from the DADS.
PGS	DADS	Quick Look Products	Quick Look Products are the result of applying science algorithms to quick-look data. These products are expeditiously sent over to the DADS, which directly routes them to the appropriate ICC and field campaign users.

Table 7-1. Conceptual PGS Data Flows (4 of 4)

From	To	Data Item	Description
DADS PGS PGS PGS	PGS DADS IMS SMC	Schedules	Schedules represent the current sequence of tasks to be executed along with approximate execution times as generated by the PGS scheduler. Copies of these schedules are made available to the IMS, the SMC, and the DADS.
DADS PGS PGS	PGS DADS SMC	Status	Status is information regarding schedules, hardware and software configuration, exception conditions, or processing performance. This information is exchanged with the DADS, and is provided to the SMC. The SMC may also receive information regarding schedule conflicts that have not been resolved with the IMS.
SCF	PGS	Test Product Reviews	Test Product Reviews are evaluations of test products that are used to determine how to proceed in the integration and test process for a new or updated algorithm. A review may indicate the need for further algorithm refinement, or it may indicate that a candidate algorithm is ready for formal adoption into the production environment. Test product reviews are received by the PGS from scientists at an SCF.
PGS	SCF	Test Products	Test Products are science products generated by new or updated algorithms during the integration and test period. Test products are delivered to scientists at an SCF.

7.5.1.5.1.3 Functional Requirements

The PGS provides four basic services:

- Scheduling, Control, and Accounting
- Product Generation
- Algorithm Test and Integration
- Product Management

The Scheduling, Control, and Accounting Service receives data availability schedules ~~from~~ **for** remote DADS, EDOS, **Pacor**, the IPs, the ADCs and ODCs, as well as specific processing requests from the IMS. It then organizes and assigns PGS internal resources to processing tasks and generates processing schedules. It coordinates with the DADS to collect and stage data required by the processing schedules, and carries out any other necessary schedule coordination with the DADS. It monitors the status of all PGS services and prepares status reports to be sent to the SMC.

The Product Generation Service consumes the largest portion of the PGS internal resources. It receives the necessary input data and algorithms from the DADS, quality checks and assesses orbit and attitude (O/A) ancillary data, generates calibrated ancillary data products and follows the processing schedules to produce Standard Products along with their associated metadata. Some automated product quality assessment will be provided. All data products are delivered to the Product Management Service.

The Product Management Service performs additional quality assessment including man-in-the-loop assessment. Data products are then released to the DADS for storage and/or routing to the appropriate destination.

The Algorithm Integration and Test Service is responsible for receiving new algorithms, algorithms updates, and calibration coefficients from scientists at the SCF. ~~or from the FOS (for engineering data) and from the FDF (for ephemeris data), and verifying that they operate properly in the product generation environment.~~ Test products are produced and delivered to the SCF for review. Algorithm validation includes final compilation and linkage of the source code to verify that the algorithm will execute properly in the operational environment but does not include verification of the scientific correctness of the algorithm. Algorithm documentation and source code are evaluated with respect to standards established by the Earth Science Data and Information System (ESDIS) Project. This service is also responsible for maintaining configuration management of these algorithms and calibration coefficients via the Local System Management (LSM) services provided by the SMC.

The Algorithm Integration and Test section also describes, in requirements PGS-0970 to PGS-1025, a set of standard algorithm support routines to be run in the production environment. The PGS is required by PGS-1030 to provide a "toolkit" to the SCF containing corresponding routines. The routines provided to the SCF by the PGS ~~shall~~ **will** provide scientists with tools that they need to simulate the operation of their algorithms in the production environment of the PGS. The routines ~~shall~~ **will** provide file access, job control, error logging, dynamic storage allocation, standard mathematical operations such as matrix inversion and fast Fourier transforms, as well as scientific routines composing a science processing library. The source code for these routines ~~shall~~ **will** be portable, and ~~shall~~ **will** have calling sequences that appear identical to the calling sequences for the corresponding routines running in the PGS processing environment. Differences between the code provided to the SCF and the corresponding code at the PGS may exist, but these differences ~~shall~~ **will** not affect the future integration of the algorithm into the PGS environment. Such differences might include, for example, a performance difference in a mathematical routine, or a difference in the output location for an error message (an error log file instead of an operator's console).

7.5.1.5.1.3.1 Scheduling, Control and Accounting Service

7.5.1.5.1.3.1.1 Scheduling

The PGS production operations are data-driven.

PGS-0002 **The PGS shall interface with the following external elements per the requirements specified in the referenced Interface Requirements Documents:**

- **a. ADCs, per the ECS to ADCs IRD**
- **b. FDF, per the ECS to FDF IRD**
- **c. TRMM, per the ECS to TRMM IRD**
- **d. ODCs, per the ECS to ODCs IRD**
- **e. SCFs, per the ECS to SCFs IRD**
- **f. SCFs, per the ECS to SCFs IRD**
- **g. EDOS, per the ECS to EDOS IRD**

PGS-0005 Each ~~DADS~~ **PGS** shall access, via the system database at the SMC, the allocation of ground event functions and capabilities to each site/element.

MOVED -- Moved from DADS1950

PGS-0010 Each ~~DADS~~ **PGS** shall access, from the SMC via the system database, the priorities used in scheduling ground events.

MOVED -- Moved from DADS1960

PGS-0015 Each ~~DADS~~ **PGS** shall access from the SMC, via the system database, the product thread information for each standard and quick-look product generated by EOSDIS.

MOVED -- Moved from DADS1970

PGS-0020 ~~Each DADS~~ **The PGS** shall receive from the SMC scheduling directives for system level, site/element-to-site/element, testing, and simulation activities.

MOVED -- Moved from DADS1980

PGS-0030 ~~Each DADS~~ **The PGS** shall receive from the SMC scheduling directives in response to emergency situations.

MOVED -- Moved from DADS2000

PGS-0040 ~~Each DADS~~ **The PGS** shall receive from the SMC schedule adjudication directives.

MOVED -- Moved from DADS2010

PGS-0050 ~~Each DADS~~ **The PGS** shall maintain a list/schedule of data ~~to be received~~ **available** from EDOS **and Pacor**.

MOVED -- Moved from DADS2030

PGS-0060 ~~Each DADS~~ **The PGS** shall insure that data sent by EDOS **and Pacor** has been received and validated.

MOVED -- Moved from DADS2040

PGS-0070 **The PGS shall coordinate with the collocated DADS, based on EDOS and Pacor data availability schedules and PGS readiness, to receive data from EDOS and Pacor.**

PGS-0080 ~~Each DADS~~ **The PGS** shall interact with EDOS, **Pacor,** and SMC to resolve schedule conflicts.

MOVED -- Moved from DADS2070

PGS-0090 The ~~LSM located at each DADS shall serve as a window through which each element's~~ **SDPS** scheduling function ~~has~~ **shall have** access to the system wide scheduling information. Such information includes, at a minimum, ESDIS Policies and Procedures regarding instrument and ground event scheduling, other element functions and capabilities, product thread information, and scheduling directives for testing, maintenance, and emergency situations.

MOVED -- Moved from DADS2120

PGS-0100 ~~Each DADS~~ **The PGS** shall coordinate and resolve schedule conflicts ~~with its collocated PGS~~ **for the SDPS.**

MOVED -- Moved from DADS2250

PGS-0140 The PGS shall provide tools to help the PGS staff create and modify ~~of its~~ **SDPS** plans, schedules, and lists.

PGS-0150 The PGS shall receive data availability schedules ~~from~~ **for** remote DADS, EDOS, **Pacor,** the IPs, the ADCs and ODCs **from the collocated DADS**.

PGS-0160 The PGS shall receive standing orders, changes to standing orders, and product requests from the IMS.

PGS-0165 The PGS shall accept priority processing requests from the IMS.

PGS-0170 The PGS shall receive priority assignments, schedule conflict resolutions, and other operational directives from the SMC.

PGS-0180 The PGS shall receive a notice from DADS when data that it has received is available.

PGS-0190 The PGS shall coordinate with the DADS on the staging of data for product production.

PGS-0210 ~~Each~~ **The** PGS shall maintain an algorithm processing control language capable of **logical** constructs ~~(e.g., if-then-else)~~ based on the complexities of the PGS. This control language shall be utilized in conjunction with a database of product specifications that contains the recipe for the generation of all Standard Products allocated to that PGS. ~~including, at a minimum~~ **The product specification consists of**:

a. The algorithm(s) to be used
b. The order in which algorithms are to be executed
c. The input data sets required
d. Time and other processing resources required

PGS-0220 The PGS shall create a reprocessing plan containing at a minimum:

a. A list of processing tasks needed to carry out each product's reprocessing
b. Estimated schedule for each task

c. The order in which tasks will be executed

PGS-0230 The PGS shall base the PGS reprocessing plan on, at a minimum:
a. Requests received from the IMS
b. SMC directives
c. The Standard Product specifications

PGS-0240 The PGS shall perform reprocessing according to the PGS reprocessing plan **and the availability of resources.**

PGS-0250 The PGS shall schedule product generation when all inputs required to generate a Standard Product for which there is a current order (from IMS) are available. Entries in the schedule shall contain, at a minimum:
a. The product to be generated
b. The specific algorithm(s) and calibration coefficients to be used
c. The specific data sets needed and their sizes
d. Priorities and deadlines that apply to the order for the product

PGS-0255 ~~Each DADS~~ **The PGS** shall notify the SMC and IMS in the event that data required in connection with an on-demand request does not arrive.

MOVED -- Moved from DADS0910

PGS-0256 ~~Each DADS~~ **The PGS** shall, in the event of noncompliance (e.g., non-arrival of scheduled data) forward a description of noncompliance to the SMC.

MOVED -- Moved from DADS0925

PGS-0260 The PGS shall schedule other functions, including, at a minimum:
a. File backups
b. File maintenance
~~c. Calibration data handling~~ **Configuration baseline changes**

PGS-0270 The PGS shall provide the capability to perform the following functions, at a minimum:
a. Allocate tasks among processors
b. Suspend execution of tasks
c. Resume execution of a suspended task
d. Cancel execution of tasks
e. Request and verify the staging and/or destaging of data stored in the DADS

PGS-0285 The PGS shall transmit to the IMS a status message to confirm or reject a processing order. The reason for rejection shall be included.

PGS-0290 The PGS shall make electronic copies of its plans and schedules available to the IMS, the SMC, and the collocated DADS.

PGS-0295 The PGS shall transmit a status message notifying the IMS of a revised completion time if processing will not complete per original schedule.

7.5.1.5.1.3.1.2 Control

PGS-0300 The PGS shall have the capability for an operator to interactively review and update the current data processing schedule.

PGS-0310 The PGS element shall collect the management data used to support the following system management functions:

a. Fault Management
b. Configuration Management
c. Accounting Management
d. Accountability Management
e. Performance Management
f. Security Management
g. Scheduling Management

PGS-0320 The PGS shall display detected faults to the system operators.

PGS-0325 The PGS ~~shall use the LSM to serve as a window through which the SMC can gain access to and receive scheduling and status information or transmit directives to the PGS~~ **shall provide the SMC with scheduling and status information, and the PGS will receive directives from the SMC.**

PGS-0330 The PGS shall ~~utilize the LSM to~~ report detected processing system faults to the SMC. ~~by including them in the PGS Status Report.~~

~~PGS-0340 The PGS shall utilize fault isolation tools provided by the LSM for the PGS and its subsystems.~~

DELETED -- Subsumed by SMC-4315.

~~PGS-0350 The PGS shall utilize tools provided by the LSM to support fault isolation between the PGS and external interfaces.~~

DELETED -- Subsumed by SMC-4315.

7.5.1.5.1.3.1.3 Accounting

PGS-0360 The PGS shall generate a PGS processing log that accounts for all data processing activities.

~~PGS-0370 The PGS shall utilize the LSM to generate a PGS resource utilization report.~~

DELETED -- Subsumed by SMC-8705.

~~PGS-0380 The PGS shall monitor its internal operations and generate a status report periodically and on request.~~

DELETED -- Subsumed by SMC-8705.

PGS-0400 The PGS shall have the capability to monitor the status of all algorithm and calibration coefficient testing and generate algorithm and calibration test reports.

PGS-0410 The PGS shall have the capability to track the processing status of all products scheduled to be generated.

~~PGS-0420 The PGS shall provide tools to analyze system performance.~~

DELETED -- Subsumed by SMC-3385.

~~PGS-0430 The PGS shall utilize the LSM to monitor and account for data and information transfer between it and other EOSDIS elements.~~

DELETED -- Subsumed by SMC-6335.

7.5.1.5.1.3.2 Product Generation Service

PGS-0435 ~~Each DADS~~ **The PGS** shall receive from the EDOS **and Pacor,** at a minimum, the following:

a. Production data (L0)
b. Quick-look data

MOVED -- Moved from DADS0130

PGS-0440 The PGS shall accept from the DADS L0-L4 data products. Received information shall contain at a minimum:

a. Product identification
b. L0-L4 data set
c. Metadata required for processing
d. Current date and time
e. DADS identification

PGS-0450 The PGS shall accept from the DADS ancillary data sets. Received information shall contain at a minimum:

a. Product identification
b. Ancillary data set
c. Metadata required for processing
d. Current date and time
e. DADS identification

PGS-0455 The PGS shall have the capability to assess the quality of spacecraft orbit and attitude (O/A) data contained in the ancillary data. QA shall be in the form of limits checking.

PGS-0456 The PGS shall notify the FDF of O/A quality checks and request updated (refined/repaired) O/A data from the FDF when necessary.

PGS-0458 The PGS shall use configuration-controlled calibration coefficients and selected engineering data to generate calibrated ancillary data products necessary as input to the generation of Level 1 Standard Products in a timeframe that assures that production schedules for all products including quick-look can be met.

~~PGS-0460 The PGS shall have the capability to use validated algorithms and calibration coefficients in the production of Standard Products.~~

DELETED -- merged with PGS-0500

PGS-0470 The PGS shall have the capability to produce each Standard Product as specified in that product's Standard Product specification.

PGS-0480 The PGS shall have the capability to perform all its processing based on priority.

PGS-0490 The PGS shall have the capability to access and use, for the generation of Standard Products, information such as:

a. Digital terrain map databases
b. Land/sea databases
c. Climatology databases
d. Digital political map databases

PGS-0500 The PGS shall have the capability to generate Level 1 through 4 Standard Products using **validated** algorithms and calibration coefficients provided by the scientists.

PGS-0510 The PGS shall have the capability to generate metadata (see Appendix C) according to the algorithms provided by the scientists and associate this metadata with each Standard Product generated.

PGS-0520 The PGS shall have the capability to generate data products from any single data input or combination of data inputs according to the algorithms provided by the scientists.

PGS-0530 The PGS shall generate quick-look products in support of field experiments, event monitoring, and instrument monitoring using algorithms and calibration coefficients provided by the scientists.

PGS-0540 The PGS shall reprocess specified science data using original or updated algorithms provided by the scientists.

PGS-0550 The PGS shall reprocess science data using the original or updated (provided by the scientists) calibration coefficients.

PGS-0560 The PGS shall maintain ~~locally, via the DADS,~~ copies of generated products to be used as inputs to other scheduled products ~~as appropriate~~ for processing efficiency.

PGS-0590 The PGS shall have the capability to indicate the temporary status of data stored in the DADS that is awaiting QA or human interaction in product production.

7.5.1.5.1.3.3 Algorithm Integration and Test Service

PGS-0600 The PGS shall provide an algorithm and calibration test and validation environment that is fully compatible with but isolated from the operational production environment.

PGS-0602 The PGS shall have the capability to accept POSIX-compliant science algorithms and compile algorithm source code written in a **the following** standard programming languages ~~(e.g., Fortran, C, Ada)~~:

a. C
b. FORTRAN
c. Ada

PGS-0605 The PGS shall process pre-launch test data and provide test data product samples for user verification.

PGS-0610 The PGS shall accept from the SCFs new or modified calibration coefficients to be validated in the test environment. Calibration coefficients shall contain the following information at a minimum:

a. Identification of coefficient data set
b. Calibration coefficients values
c. Author and version number
d. Identification of related processing algorithm
e. Start and stop date/time of applicability

~~f. Documentation (e.g., author, date and time, SCF identification, reasons for update, etc.)~~

f. Date and time

g. SCF identification

h. Reasons for update

PGS-0620 The PGS shall have the capability to validate received calibration coefficients for completeness and correct format.

PGS-0630 The PGS shall send the DADS new or modified calibration coefficients which shall contain the following information at a minimum:

a. Identification of coefficient data set
b. Calibration coefficients values
c. Author and version number
d. Identification of related processing algorithm
e. Start and stop date/time of applicability
f. Documentation

PGS-0640 The PGS shall accept from the SCF new or modified Standard Product algorithms to be tested at the processing facility. This software shall be received into the test environment and shall contain the following information at a minimum :

a. Algorithm identification
b. Algorithm source code
c. List of required inputs
d. Processing dependencies
e. Test data and procedures
f. Algorithm documentation

PGS-0650 The PGS shall have the capability to validate required operational algorithm characteristics prior to scheduling algorithm test time. These characteristics shall be include at a minimum:

a. Language
b. Operational impacts (~~e.g.~~ **i.e.**, algorithm software size, required resources)
c. Algorithm documentation
d. Data handling standards as appropriate
e. Units and models used
f. Operational compatibility
g. Required metadata outputs

PGS-0860 The PGS shall have the capability to schedule and coordinate algorithm and calibration coefficient test time in the test environment with the appropriate SCF.

PGS-0870 The PGS shall have the capability to schedule algorithm test resources that do not interfere with the operational production environment.

PGS-0900 The PGS shall **have the capability to** send test products to the SCF for analysis. These shall contain the results of algorithm testing and shall contain the following information at a minimum:

a. Algorithm identification
b. Test time(s)
c. Processor identification
d. Test results

PGS-0910 The PGS shall have the capability to support analysis of algorithm test results.

PGS-0920 The PGS shall have the capability to validate, through testing, that SCF processing algorithms will execute properly in the operational environment. Validation shall include final compilation and linkage of the source code and testing to verify proper software execution in the operational environment based on indicated data and test results provided by the SCF and the investigator, but shall not include scientific validation of products.

PGS-0925 The PGS shall validate algorithms used for conversions, calibrations and transformations of EOS engineering data.

PGS-0930 The PGS shall have the capability to transfer validated algorithm software and calibration coefficients from the test environment to the operational environment to be used in the production of Standard Products.

PGS-0940 The PGS shall provide storage for all candidate algorithms' software executables and calibration coefficients.

PGS-0950 The PGS shall ~~have the capability to utilize the LSM toolkit~~ **interface to the SMC** to maintain configuration control of all algorithms and calibration coefficients used in operational Standard Product production. Controlled information shall contain at a minimum:

a. Source code including version number and author
b. Benchmark test procedures, test data, and results
c. Date and time of operational installation
d. Compiler identification and version
e. Final algorithm documentation

PGS-0960 The PGS shall send the DADS new or modified algorithms. This delivery shall contain the following information at a minimum:

a. Source code including version number and author
b. Benchmark test procedures, test data and results
c. Date and time of operational installation
d. Final algorithm documentation
e. Calibration coefficient values

PGS-0970 The PGS shall provide file access subroutines that enforce compliance with the adopted standard ECS formats.

PGS-0980 The PGS shall provide job control routines that provide all required task parameters to the Standard Product software.

PGS-0990 The PGS shall provide error logging subroutines for use by Standard Product software in notifying the system operators of conditions requiring their attention.

PGS-1000 The PGS shall provide error logging subroutines for use by Standard Product software in notifying users of conditions requiring their attention.

PGS-1010 The PGS shall provide mass storage allocation subroutines that provide algorithms with a means for dynamic allocation of storage for temporary files.

PGS-1015 The PGS shall provide ancillary data access subroutines that provide Standard Product software access to ephemeris data ~~(e.g.~~ **i.e.,** solar, lunar, and satellite ephemeris), Earth rotation data, and time and position measurement data. These subroutines shall perform **the following** operations ~~such as~~:

a. Interpolation
b. Extrapolation

c. Coordinate system conversion

PGS-1020 The PGS shall provide **the following** mathematical libraries ~~including~~:
a. Linear algebra and analysis ~~(e.g., LINPAC, IMSL)~~
b. Statistical calculations ~~(e.g., SAS, SPSS)~~

PGS-1025 The PGS shall provide a science processing library containing **the following** routines ~~such as~~:
a. Image processing routines
b. Data visualization routines
c. Graphics routines

PGS-1030 The PGS shall provide a toolkit to the SCF containing versions of the routines specified in requirements PGS-0970 to PGS-1025.

7.5.1.5.1.3.4 Product Management Service

PGS-1050 The PGS shall ~~provide the capability to perform~~ **support** both automatic and manual QA of generated products.

PGS-1060 The PGS shall have the capability to execute QA algorithms provided by the scientists.

PGS-1080 The PGS shall have the capability to provide an inventory and review copy of generated products to the data product quality staff before the product is sent to the DADS for storage.

PGS-1090 The PGS shall have the capability to provide the data product quality staff with the algorithms, calibration coefficient tables, input data sets, or other information related to product processing for the purpose of reviewing and analyzing the quality of production.

PGS-1100 The PGS shall have the capability to accept product quality data input.

PGS-1110 The PGS shall have the capability to associate data quality with a generated product.

PGS-1120 The PGS shall send the DADS updated metadata provided by the data product quality staff relating to product QA review. This QA review metadata shall contain the following information at a minimum.
a. Product ID
b. QA Approval field
c. Other metadata

PGS-1130 The PGS shall receive product QA from the SCF which shall describe the results of the scientist's product quality review at an SCF. Product QA shall contain the following information at a minimum:
a. Identification of product
b. QA results
c. Product storage and processing instructions

PGS-1140 The PGS shall have the capability to provide the data product quality staff with the Product QA data from the SCF.

PGS-1150 The PGS shall have the capability to accept the identification of products that are not to be stored in the DADS due to inferior quality or other reasons. The reason for all such actions shall also be specified.

PGS-1160 The PGS shall have the capability to accept from the product quality staff commands to suspend specified production processing due to inferior quality or other reasons in line with SMC guidelines. The reasons for all such actions shall also be specified.

PGS-1170 The PGS shall ~~receive from the DADS a QA timeout notice. This notice shall indicate that a product awaiting QA had not been reviewed within the specified amount of time, and therefore was stored in the archives without review~~ **have the capability to identify data products awaiting QA that have not been reviewed within the specified amount of time.**

PGS-1175 ~~Each DADS~~ **The PGS shall** maintain a list of products requiring QA by SCF or the PGS.

MOVED -- Moved from DADS1170

PGS-1180 The PGS shall have the capability to update the processing status of a given product as a result of ~~receiving~~ a QA timeout ~~notice~~.

PGS-1190 The PGS shall have the capability to log the identification of all non-stored products or suspended processing directed by the data product quality staff to support the maintenance of performance statistics.

PGS-1200 The PGS shall have the capability to generate a data quality assessment report including a description of the quality of each processed product as well as the quality of each of the product's input data sets.

PGS-1210 The PGS shall coordinate the disposition of data stored **by the PGS** temporarily in the DADS.

PGS-1220 The PGS shall have the capability to receive **the following GFE provided** databases~~, including COTS databases,~~ and maintain them as required as inputs to product generation: ~~Example These databases are:~~

a. Digital terrain map databases
b. Land/sea databases
c. Climatology databases
d. Digital political map databases

PGS-1230 The PGS shall accept special data sets from the DADS. Received information shall contain at a minimum:

a. Product identification
b. Special data set
c. Metadata required for processing
d. Current date and time
e. DADS identification

PGS-1240 The PGS shall send the generated Level 1 to Level 4 Standard Products to the DADS. These products shall contain the following information at a minimum:

a. Product identification
b. L1-L4 data set
c. Product processing priority
d. Current date and time

e. Associated metadata

PGS-1250 The PGS shall send the DADS the calibrated ancillary data ~~for routing to the appropriate destination (e.g., SCF, remote DADS)~~.

PGS-1260 The PGS shall send the DADS quick-look products ~~for routing to the appropriate destination (e.g., ICC, SCF)~~.

7.5.1.5.1.4 PGS Performance

PGS-1310 The processing capacity necessary to process all EOS science data for which each PGS is responsible shall be based on the data volumes and at-launch instrument processing load requirements (MFLOPS) assigned to each DAAC as well as the 20% yearly product growth as specified in Appendix C.

PGS-1315 Each PGS shall have the capacity to support I/O to temporary and intermediate storage ~~or multiple passes over input products~~ as required by individual science algorithms.

PGS-1300 Each PGS shall provide a processing capacity four times the size necessary to process all EOS science data for which it is responsible, including interdisciplinary investigator processing ~~(1 times to allow for normal processing demands, 2 times to allow for reprocessing demands, and 1 times to allow for algorithm integration and test demands, production of prototype products, ad hoc processing for "dynamic browse" or new search techniques developed by science users, quick-look processing, and additional loads due to spacecraft overlap). In addition, the effective processing rates for sizing purposes shall be assumed to be not greater than 25% of peak-related CPU capacity. It shall be possible to effectively utilize the entire reprocessing capacity at each site for a single algorithm or any mix of algorithms normally run at that site.~~. **The four times processing capacity accounts for:**

a. 1 times to allow for normal processing demands

b. 2 times to allow for reprocessing demands

c. 1 times to allow for algorithm integration and test demands (production of prototype products, ad hoc processing for "dynamic browse" or new search techniques developed by science users, quick-look processing, and additional loads due to spacecraft overlap)

PGS-1301 The effective CPU processing rates used for sizing purposes in PGS-1300 shall not be greater than 25% of peak-related CPU capacity.

PGS-1305 ~~Each DADS~~ **The PGS** shall be capable of ~~ingesting~~ **receiving** data at the maximum output bandwidth **of TBR** from the EDOS.

MOVED -- Moved from DADS2780

PGS-1270 The PGS design and implementation shall have the flexibility to accomodate PGS expansion up to a factor of 3 in the processing capacity with no changes to the processing design, and up to a factor of 10 without major changes to the processing design. Such expansion in capacity or capability shall be transparent to existing algorithms or product specifications. This requirement shall apply to the system at all phases of contract performance, including the final system which accommodates the product growth specified in Appendix C, as well as the at-launch system.

7.5.1.5.1.5 Application Programming Interfaces (APIs)

PGS-1400 **The PGS shall be developed with configuration-controlled application programming interfaces (APIs) that will be capable of supporting development and integration of new algorithms developed at each DAAC to support DAAC value-added production.**

PGS-1410 **The PGS shall provide the capability for each DAAC to add to the data production environment toolkit DAAC-developed software required to support discipline specific needs.**

7.5.1.5.2 Data Archive and Distribution System (DADS)

7.5.1.5.2.1 Overview

DADS is the element of ~~EOSDIS~~ **ECS** that stages data needed for processing at its collocated PGS, archives EOS and non-EOS data, and distributes it on request over networks or on a variety of physical media. Science products are provided by DADS to other DAACs, ADCs, ICCs, ODCs, IPs, science teams at their computing facilities, government and commercial users, and the general scientific community.

Each DADS receives and stores production and quick-look data from EDOS **via PGS** and IPs, data products from its collocated PGS, special data products and other information from the SCFs, and ancillary and other data from ~~EPDSs~~ **Landsat 7 DHF, TRMM Ground Segment**, ADCs, and ODCs. DADS ~~verifies these~~ **checks the** data **for consistency**, updates their metadata with inventory control and ~~QA~~ **consistency check** information, and stages them for distribution or archiving as necessary. The storage at each DADS may be composed of devices and technologies of varying capabilities in terms of speed of access, capacity, and cost.

Each DADS routinely retrieves requested data from the archive, and generates subsets, subsamples or summary data products. Certain data may be compressed without loss prior to storage or distribution if appropriate.

DADS distributes data electronically over the EOSDIS Science Network (ESN) or on selected physical media in response to user requests received via the IMS. These are packaged and mailed to the requestor as expeditiously as possible. ~~DADS also provides for the ongoing maintenance and restoration of media as it ages.~~

DADS management allocates resources ~~and, in conjunction with SMC~~, ~~monitors and~~ **receives** ~~schedules~~ **management directives** ~~processing~~, oversees systems, **and** media ~~and communications~~ performance, and provides for the development, testing, and integration of DADS hardware and software. **DADS also provides for the ongoing maintenance and restoration of media as it ages.**

7.5.1.5.2.2 Conceptual DADS Architecture

The DADS is responsible for ingesting, archiving, and distributing EOS and non-EOS Earth science data and data products. A DADS will be ~~co-located~~ **collocated** with a PGS at each of the DAAC sites. Each DADS ingests Level 0 data products ~~from EDOS~~ and ancillary data sets from other DADS, ADCs, **Landsat 7 DHF, TRMM Ground System**, or ODCs and makes these available on a high data transfer rate staging buffer to its ~~co-located~~ **collocated** PGS for use in generating higher level products. The PGS products are made available to DADS on the same staging buffer for entry into the DADS archive and distribution to users. All data in the archive are ~~automatically accessible and are~~ managed for retrieval, restoration, and hierarchy level by a sophisticated, yet robust, file and storage management system capable of dealing with the quantity of large files indicated in Appendix C. Each DADS will distribute data both via network and on a variety of physical media in response to data requests from the IMS.

These principal functions may be a set of separate processes running simultaneously on a single processor, or components of a master process, or the elements of a distributed process running on different and, perhaps, multiple processors.

7.5.1.5.2.2.1 DADS Interfaces

The DADS interfaces and the data flows between them are shown in Figure ~~7.5.1.5.2.2.1-1~~ **7-4**, the Conceptual DADS Context Diagram.

ADC: Interfaces with DADS ~~shall~~ **will** be established for the collection of data sets required for the production of Standard Products.

EDOS: Each DADS ~~shall~~ **will** receive ~~production and quick-look data~~ **data availability schedules** from EDOS. ~~EDOS will be the DADS backup for these data.~~ The EDOS will accept DADS requests for production data (Level 0) from the back-up archive, and deliver the requested products to ~~the DADS~~ **PGS for processing**.

DAAC: Interfaces with other DADS ~~shall~~ **will** be established for the collection of data sets required for the production of data products.

EOC: An interface ~~shall~~ **will** be established between the EOC and the GSFC DADS for archiving all spacecraft status and historical data.

EPDS: Interfaces with ~~Earth Probe Data Centers~~ **TRMM and LANDSAT-7 facilities** shall be established for the ingest and archive of ~~Earth Probe~~ **TRMM and LANDSAT-7** data products.

FDF: DADS ~~shall~~ **will** receive from the FDF **predictive and** repaired or refined orbit and attitude data products.

ICC: An interface ~~shall~~ **will** be established between each ICC and DADS for archiving instrument status information and instrument historical data and distributing quick-look products.

IMS: The IMS ~~shall~~ **will** provide each DADS with authorized orders for data sets located in the archives, and allow the IMS to check on the status of the preparation and distribution of those orders. Since the IMS is the gateway into EOSDIS for users to order data, DADS ~~shall~~ **will** notify the IMS of any problems or conflicts that might jeopardize a product order from being delivered on schedule.

IP: Interfaces with IPs ~~shall~~, **including ESA and ASTER, will** be established for the collection of data sets required for the production of Standard Products or for distribution to authorized EOSDIS elements or users. Data sets from IP spacecraft which have been processed through L0 will be sent to a designated DADS.

ODC: Interfaces with ODCs ~~shall~~ **will** be established for the collection of data sets required for the production of Standard Products or for distribution to authorized EOSDIS elements or users.

PGS: Each DADS ~~shall~~ **will** store the instrument data on a **high data transfer rate** staging ~~area~~ **buffer**. Following a formal schedule, the DADS informs the PGS when all required data is ready for the PGS to process. The products generated by the PGS are placed back on the staging ~~area~~ **buffer** where the DADS verifies their metadata, processes order requests, and archives them.

SMC: The SMC ~~shall~~ **will** provide each DADS with management and operational directives, including ~~schedule adjustment,~~ configuration management and security information. Each DADS will make available to SMC its status in each of the directive areas. This will include resource utilization data for user accounting and ~~billing~~ **invoicing** purposes.

SCF: An interface between each DADS and SCF ~~shall~~ **will** provide for an exchange of documents, special data products, metadata, correlative data, calibration data, ancillary data, and algorithms. Standard Products will be distributed to SCF for QA or analysis purposes.

USER: An interface with the science user ~~shall~~ **will** provide for the on-request distribution of data products, algorithms, and documents from DADS to users. The interface ~~shall~~ **will** also provide for the receipt and ingestion by DADS of correlative data and documents from users.

7.5.1.5.2.2.2 Data Flows

Data flows between each DADS and its interfaces are identified in Figure ~~7.5.1.5.2.2.1-1~~ **7-4**. A description of these data flows is presented below.

7.5.2.2.2 Conceptual DADS Data Flows

Table 7-2 lists and describes the data flows between the DADS and other EOSDIS and non-EOSDIS elements.

7.5.1.5.2.3 Functional Requirements

There ~~shall~~ **will** be five major services at each DADS. They are:

1. Ingest
2. Archive
3. Process Orders/ **Requests**
4. Manage System
5. Distribution

The Ingest service ~~shall~~ **will** accept metadata updates, hardcopy, and the various types of EOS and non-EOS data sent to the DADS. All data received at the DADS ~~shall~~ **will** be verified and the metadata associated with the data ~~shall~~ **will** be updated.

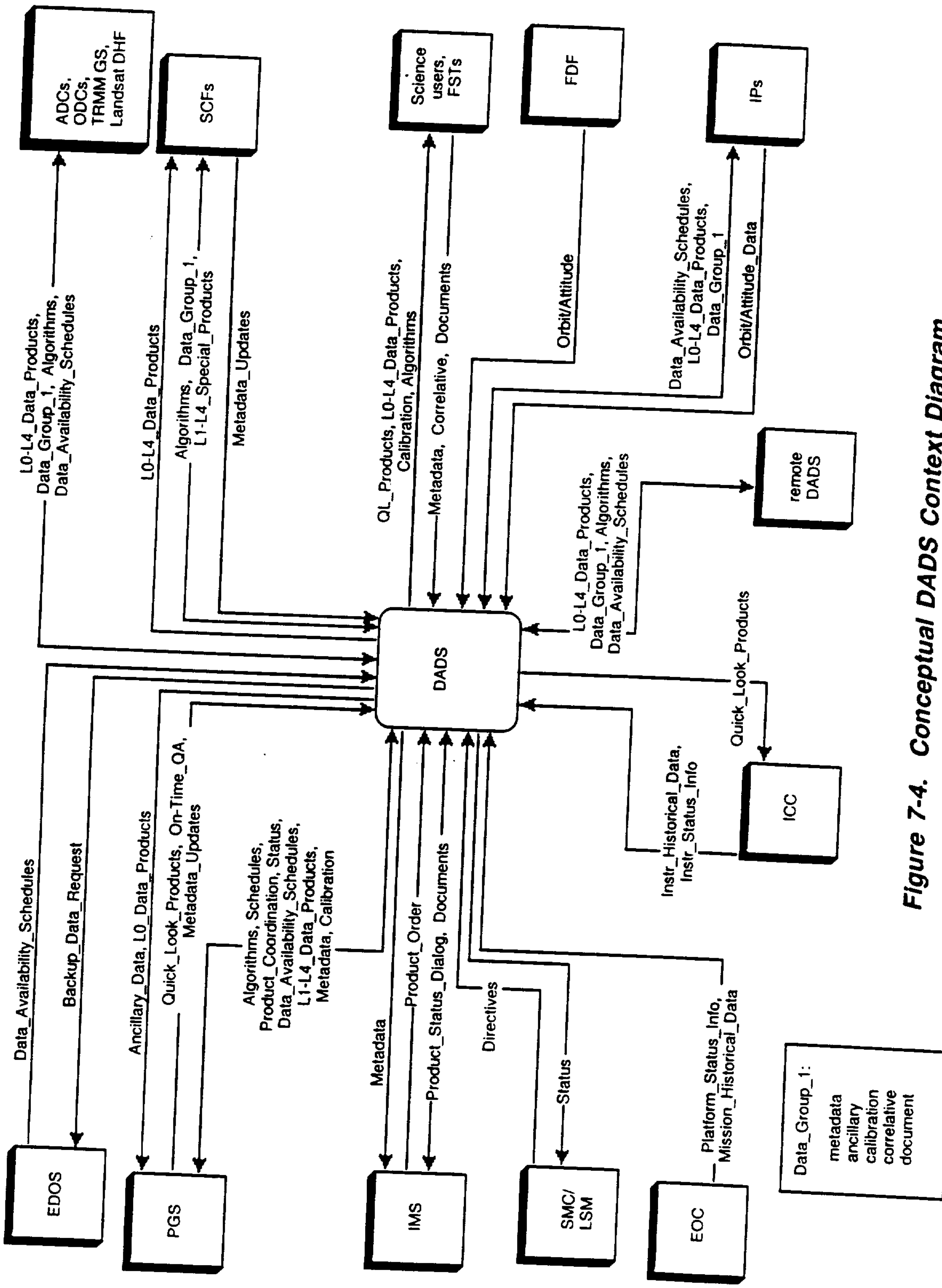


Figure 7-4. Conceptual DADS Context Diagram

Table 7-2. Conceptual DADS Data Flows (1 of 5)

From	To	Data Item	Description
DADS	PGS	Ancillary Data	Data products required as input to generate Standard Products. This may include selected engineering data from an EOS spacecraft, ephemeris data, as well as non-EOS ancillary data.
DADS	PGS	Algorithms	ALGORITHMS which have been produced by SCF personnel and accepted for operational use by a PGS ~~shall~~ **will** be archived at the collocated DADS. The DADS ~~shall~~ **will** also archive algorithms contributed as EOSDIS resources by other data centers. Algorithms ~~shall~~ **will** be orderable and distributed to authorized users.
PGS	DADS		
ADCs, ODCs, TRMM	DADS		
DADS	ADCs, ODCs, TRMM		
Remote DADS	DADS		
DADS	Remote DADS		
SCF	DADS		
DADS	SCF		
Users, FSTs	DADS		
DADS	Users, FSTs		
DADS	EDOS	Backup Data Request	Request for replacement products.
DADS	Users, FSTs	Calibration	Data required to calibrate spacecraft, instrument science and engineering data.
PGS	DADS		
DADS	PGS		
Users, FSTs	DADS	Correlative Data	Scientific data needed to evaluate and validate EOS data products.

Table 7-2. Conceptual DADS Data Flows (2 of 5)

From	To	Data Item	Description
EDOS ADCs, ODCs IP Remote DADS DADS DADS	DADS DADS DADS DADS Remote DADS PGS	Data Availability Schedules	Schedule indicating the times at which specific data sets will be available from remote DADS, EDOS, the IPs, the ADCs and ODCs. The schedules are received by DADS and provided to the PGS.
ADCs, ODCs, Landsat, TRMM DADS DADS SCF IP DADS Remote DADS DADS	DADS ADCs, ODCs, Landsat, TRMM SCF DADS DADS IP DADS Remote DADS	Data Group 1	Metadata, ancillary data, calibration information, correlative data and documents.
LSM	DADS	Directives	The set of policies, procedures, and directives regarding schedules, configuration management, security, etc., which ~~shall~~ **will** be provided to each DADS by the SMC.
Users, FSTs IMS DADS	DADS DADS IMS	Documents	The hardcopy or digitized references or records about an instrument or the products generated from its data. These ~~shall~~ **will** be archived at DADS.

Table 7-2. Conceptual DADS Data Flows (3 of 5)

From	To	Data Item	Description
ICC	DADS	Instrument Historical Data	History of instrument operations, including commands sent and all indications of successful and failed commands, for archival.
ICC	DADS	Instrument Status Information	High-level information about the status of an instrument stored in a designated DADS.
ADCs, ODCs, Landsat, TRMM DADS DADS DADS IP DADS DADS Remote DADS PGS DADS	DADS ADCs, ODCs, Landsat, TRMM SCF Users, FSTs DADS IP Remote DADS DADS DADS PGS	L0-L4 Data Products	Standard Products consisting of L0, L1A, L1B, L2, L3, and L4 which ~~shall~~ **will** be distributed by DADS to authorized requestors. This data is archived at the DADS and is also available for reprocessing by the PGS.
SCF DADS	DADS SCF	L1-L4 Special Products	Set of special science data products consisting of L1A, L1B, L2, L3, and L4 which are produced at the SCFs. These ~~shall~~ **will** be archived at the DADS and distributed to authorized requestors.

Table 7-2. Conceptual DADS Data Flows (4 of 5)

From	To	Data Item	Description
ADCs, ODCs, Landsat, TRMM DADS Users, FSTs DADS PGS DADS	DADS ADCs, ODCs, Landsat, TRMM DADS IMS DADS PGS	Metadata	Information about data sets which provides a logical and technical description of the content, format, and utility of the data set. Metadata is received by each DADS with the corresponding data sets. DADS validates it physically, updates it with inventory information, enters it into a distributed database (to which the IMS has access), and archives it. Metadata about special products produced at SCF ~~shall~~ **will** be sent to DADS along with their associated data products.
SCF PGS	DADS DADS	Metadata Updates	Updates to the metadata received from SCF and PGS to complete the QA fields of the metadata.
EOC	DADS	Mission Historical Data	Information regarding EOS mission operations including instrument command histories, instrument operational histories, etc.
PGS	DADS	On-Time QA	Response to a data quality request that is received within the established production time window.
FDF IP	DADS DADS	Orbit/Attitude Refined Orbit/Attitude	Orbit and attitude parameters which will be provided by the FDF or the IPs.
EOC	DADS	Platform Status Information	High-level spacecraft status information archived in a designated DADS.
PGS DADS	DADS PGS	Product Coordination	Product Coordination is the coordination of the receipt, staging, and storage of data necessary to carry out the PGS processing schedule.

Table 7-2. Conceptual DADS Data Flows (5 of 5)

From	To	Data Item	Description
IMS	DADS	Product Orders	Request from the IMS for a standard or special product but may also be for algorithms, documents, or other data, archived at the DADS.
DADS IMS	IMS DADS	Product Status Dialog	Current status of a product which has been requested by a user or element. This product status ~~shall~~ **will** be routinely available to IMS from any DADS.
DADS DADS PGS	Users, FSTs ICC DADS	Quick-Look Product	Quick-look data that has been priority processed by a PGS prior to being sent to an ICC and field campaign users.
DADS DADS PGS	LSM PGS DADS	Status	STATUS is the handshaking type of acknowledgement between a PGS and its collocated DADS that a product is ready to be transferred from one to the other. In addition status is the scheduling, resource, accounting, or fault resolution type of information which ~~shall~~ **will** be made continuously available to SMC.

The Archive service ~~shall~~ **will** transcribe onto archival media and enter into the archive at the DADS, data that have been ingested.

The Process Orders**/ Requests** service ~~shall~~ **will** receive orders, retrieve data from media, ~~subset when requested, and reformat the data~~ **and perform data transformation and reformatting as directed**. In addition, each DADS ~~shall~~ **will** update inventory, generate accounting information, provide a ~~request~~ **response** status, and store the data in a staging area when required.

The Management service ~~shall~~ **will** monitor the performance of the system, provide data restoration, determine the level of archive, and perform configuration management and testing.

The Distribution service ~~shall~~ **will** distribute data either via a network or on a variety of physical media, and package and mail it.

7.5.1.5.2.3.1 Ingest

7.5.1.5.2.3.1.1 Receive Metadata Updates

DADS0005 The DADS shall interface with the following external elements per the requirements specified in the referenced Interface Requirements Documents:

a. ADCs, per the ECS to ADCs IRD

b. FDF, per the ECS to FDF IRD
c. ESA, per the ECS to ESA IRD
d. ASTER Ground System, per the ECS to ASTER IRD
e. NASDA, per the ECS to NASDA IRD
f. TRMM, per the ECS to TRMM IRD
g. ODCs, per the ECS to ODCs IRD
h. Landsat-7, per the ECS to Landsat-7 IRD
i. Version 0, per the ECS to Version 0 IRD
j. SCFs, per the ECS to SCFs IRD
k. EDOS, per the ECS to EDOS IRD

DADS0010 Each DADS shall receive ~~from the SCF~~ updated metadata for products ~~which have~~ **that have** been QA'd ~~by the SCF~~.

DADS0020 Each DADS shall, upon receipt of updated metadata for products which have been QA'd ~~at SCF~~, store the metadata in its inventory.

~~DADS0030 Each DADS shall receive from the PGS updated Metadata for products which have been QA'd at the PGS during product generation.~~

DELETED -- Redundant functionality with DADS0010

7.5.1.5.2.3.1.2 Receive Hardcopy

DADS0070 Each DADS shall provide the capability of scanning or digitizing hardcopy input for the purpose of archiving documents.

7.5.1.5.2.3.1.3 Receive Data

~~DADS0090 Each DADS shall be capable of receiving and archiving three days' worth of data (see Appendix C) in any given day.~~

MOVED -- Moved to DADS2778

DADS0100 Each DADS shall receive **management directives** from the SMC ~~, at a minimum, management directives such as schedule adjustments~~.

DADS0110 Each DADS shall receive from the IMS, at a minimum, the following:
a. Documents
b. Product status dialog
c. Product orders

DADS0120 Each DADS shall receive from the PGS, at a minimum, the following:
a. L1-4 products
b. Quick-look products
c. Metadata
d. Calibration
e. Algorithms
f. Schedule
g. Status

~~DADS0130 Each DADS shall receive from the EDOS, at a minimum, the following:~~

~~a. Production data (L0)~~
~~b. Quick-look data~~

MOVED -- Moved to PGS-0435

DADS0140 Each DADS shall receive from other DAACs, at a minimum, the following for the purpose of product generation:

a. L0-L4
b. Metadata
c. Ancillary data
d. Calibration data
e. Correlative data
f. Documents
g. Algorithms

DADS0145 Each DADS shall be capable of receiving from the ADCs, at a minimum, the following for the purpose of product generation:

a. L0-L4 equivalent data sets
b. Metadata
c. Ancillary data
d. Calibration data
e. Correlative data
f. Documents
g. Algorithms

DADS0150 Designated DADS shall receive from the ICC, at a minimum, the following:

a. Instrument ~~historical data~~ **history log (or subset of history log)**
b. ~~Instrument status info~~ **Associated Metadata**

DADS0160 A designated DADS shall receive from the EOC, at a minimum, the following:

a. Spacecraft ~~status info~~ **history log (or subset of history log)**
b. ~~Mission historical data~~ **Associated Metadata**

DADS0170 Each DADS shall be capable of receiving from ~~designated EPDSs and~~ ODCs, at a minimum, the following:

a. L0-L4 data sets
b. Metadata
c. Ancillary data
d. Calibration data
e. Correlative data
f. Documents
g. Algorithms

DADS0175 The GSFC DADS shall receive from FDF: , at a minimum, orbit and attitude data.

DADS0180 Each DADS shall receive from the users, at a minimum, the following:

a. Metadata
b. Correlative data
c. Documents
d. New derived data sets

DADS0190 Each DADS shall receive from the SCF, at a minimum, the following:
a. Special products (L1-L4)
b. Metadata
c. Ancillary data
d. Calibration data
e. Correlative data
f. Documents
g. Algorithms

DADS0200 Each DADS shall receive from the IPs, at a minimum, the following:
a. L0-L4 data products
b. Orbit/attitude data
c. Metadata associated with data sets
d. Ancillary data
e. Calibration data
f. Correlative data
g. Documents
h. Algorithms

DADS0210 Each DADS shall be capable of receiving, at a minimum, the following types of EOS instrument data in support of pre-launch checkout of the ground system:
a. Real EOS instrument data
b. Simulated EOS instrument data

DADS0220 Each DADS shall accept, at a minimum, the following data types in support of development of initial calibration:
a. Instrument calibration data
b. Scientific calibration

DADS0240 Each DADS shall accept from the SMC, at a minimum, detailed science plans.

DADS0250 Each DADS shall receive, at a minimum, data in the following forms:
a. Physical electronic media
b. Electronic communications network
c. Hardcopy media

DADS0260 Each DADS shall receive non-EOS correlative and ancillary digital data.

~~DADS0280 Prior to the launch of each EOS spacecraft and instruments, the DADS shall be capable of ingesting and providing access to the data to support the instrument science team(s) in: the pre-launch checkout of their instruments, the pre-launch science checkout, and the development of initial calibration information.~~

MOVED -- Moved to DADS2315; portions subsumed in DADS0281.

DADS0281 Each DADS shall be capable of ingesting data to support the instrument science team(s) in:
a. Pre-launch checkout of their instruments
b. Pre-launch science checkout
c. Development of initial calibration information.

DADS0282 Each DADS shall be capable of ~~processing, for~~ storage and retrieval **of** real and simulated EOS instrument data in support of pre-launch checkout of the ground system.

MOVED -- Moved from DADS2790.

7.5.1.5.2.3.1.4 Automated ~~Quality Assessment~~ Data Checking

DADS0290 Each DADS shall ~~verify~~ **check** all metadata and data it receives. For each type of data described by the metadata, the ~~verification~~ **data** shall ~~consist of~~ **be** ~~checking~~ **checked** for the presence of required fields, error-free input, correctness of the data set granule size, and other checks as required.

DADS0300 Each DADS shall generate ~~QA~~ status indicating the success or failure of metadata and data ~~verification~~ **consistency checks.**

DADS0310 Each DADS shall verify that data received came from an approved/ authorized source.

DADS0320 Each DADS shall verify compliance of scientist provided data with EOSDIS defined standards for metadata and file content (not scientific content).

7.5.1.5.2.3.1.5 Generate Metadata

DADS0350 Each DADS shall generate the following metadata items, at a minimum:

a. ~~Granule Id~~ **Deleted**
b. Date and time of storage
c. Physical location (i.e., DADS Id.)
d. ~~QA~~ **Data check status**

DADS0360 Each DADS shall augment PGS-generated metadata with DADS-generated metadata.

DADS0370 Each DADS shall provide the IMS with metadata on newly stored data ~~sets~~ **granules.**

7.5.1.5.2.3.2 Archive

DADS0405 Each DADS shall provide the capability to archive multiple versions of a selected product.

MOVED -- Moved from DADS0630

DADS0410 Each DADS shall archive the current version of a product, making the preceding version of a product eligible for deletion.

MOVED -- Moved from DADS0620

DADS0412 Each DADS shall notify users**, via the ECS Bulletin Board,** when a product becomes eligible for deletion. The product to be deleted shall be held in the archive for six months from the date of notification.

MOVED -- Moved from DADS0640

DADS0425 Each DADS shall archive data on archive quality media ~~meeting National Archives and Records Administration (NARA), National Institute for Standards and Technology (NIST), and NASA~~**in accordance with the following standards: (TBR)**

DADS0430 Each DADS shall provide its operations personnel the capability to manually alter the routing of data sets to physical storage locations.

DADS0435 At each DADS operations personnel shall be able to add new physical volumes and eject physical volumes from the archive for off-line or off-site permanent storage.

MOVED -- Moved from DADS3020

DADS0440 Each DADS shall provide storage, at a minimum, for the following EOS data:

a. Standard Products
b. Associated correlative data sets
c. Associated ancillary data sets
d. Associated calibration data sets
e. Associated metadata

DADS0450 Each DADS shall provide storage, at a minimum, for the following scientist provided data:

a. Special data products
b. Associated correlative data sets
c. Associated ancillary data sets
d. Associated calibration data sets
e. Research results (articles, algorithms, data sets, software)
f. Instrument characterization data sets
g. Associated Metadata

DADS0460 Each DADS shall provide storage~~,~~ at a minimum, for non-EOS data required for Standard Product production by the PGS.

DADS0465 The DADS shall provide storage for the following Version 0 data:

a. Standard products
b. Associated correlative data sets
c. Associated ancillary data sets
d. Associated calibration data sets
e. Associated metadata
f. Documents
g. Algorithms

DADS0470 The EDC DADS shall store non-browse Landsat-7 data products for a duration of thirty days from the time of receipt.

DADS0475 The DADS shall provide storage for the following TRMM data:

a. L0-L4 equivalent data products
b. Associated correlative data sets
c. Associated ancillary data sets
d. Associated calibration data sets

e. **Associated metadata**
f. **Documents**
g. **Algorithms**

~~DADS0485 Each DADS shall ensure that the capability to backup its archive is in place, by storing a backup copy of data and products, or a single copy and all information required to regenerate products if that copy is lost, or a combination of the two approaches.~~

MOVED -- Moved to DADS2276

~~DADS0487 DADS shall store EDOS production data sets (Level 0) for at least one year from the date they are ingested.~~

DELETED -- Subsumed by DADS0488

DADS0488 Each DADS shall archive the EDOS production data sets (Level 0) received from ~~EDOS~~ **PGS**, or the equivalent Level 1A data.

DADS0490 Each DADS shall archive Level 1B - Level 4 data products.

~~DADS0495 Each DADS shall be capable of screening its archive holdings of Level 1A or Level 0 data, and if a product(s) is found to be lost or unreadable, generate a request for a replacement product from EDOS, dispatch the request, and ingest the replacement product.~~

MOVED -- Moved to DADS1450

7.5.1.5.2.3.3 Process Orders/Requests

7.5.1.5.2.3.3.1 Receive Orders/Requests

DADS0498 Each designated DADS shall receive standing and retrospective product orders from the IMS.

MOVED -- Moved from DADS2080

DADS0500 Each DADS shall receive changes to standing orders from the IMS.

DADS0520 Each DADS shall accept requests ~~from the PGS~~ for data needed for Standard Product production.

DADS0525 Each DADS shall accept updates/ cancellations of **data order** requests ~~originating via the IMS or the PGS~~**.**

MOVED -- Moved from DADS0650

DADS0540 Each DADS shall notify the PGS of the receipt of non-EOS data sets required for Standard Product production.

DADS0550 Each DADS shall notify the PGS of the receipt of EOS data sets required for Standard Product production (e.g., data received from non-collocated DADS).

~~DADS0560 Each DADS shall receive product orders from the IMS.~~

DELETED -- Subsumed by DADS0498 and DADS0600

DADS0570 Each DADS shall verify product orders from the IMS. ~~Verification shall consist of checking all fields in the request.~~

DADS0590 Each DADS shall support the capability for subsetting, and subsampling data products ordered via the IMS.

DADS0600 Each DADS shall accept requests from the IMS to distribute data archived in the DADS to requesting users.

~~DADS0610 Each DADS shall support reprocessing.~~

DELETED -- Subsumed by DADS0405 and DADS2330

~~DADS0620 Each DADS shall archive the current version of a product, making the preceding version eligible for deletion.~~

MOVED -- Moved to DADS0410

~~DADS0630 Each DADS shall provide the capability to archive multiple versions of a selected product.~~

MOVED -- Moved to DADS0405

~~DADS0640 Each DADS shall notify users when a product becomes eligible for deletion. The product to be deleted shall be held in the archive for six months from the date of notification.~~

MOVED -- Moved to DADS0412

~~DADS0650 Each DADS shall accept updates/cancellations of requests originating via the IMS or the PGS.~~

MOVED -- Moved to DADS0525

DADS0660 Each DADS shall ~~maintain~~ **access** a database of orders which shall include at a minimum: priorities, distribution directions, and all other details necessary to process orders including standing and multi-DADS orders.

~~DADS0670 Each DADS shall prepare for delivery on hard media any requested data granules stored in the archive within 24 hours of receiving the request.~~

DELETED -- Subsumed by DADS2770

~~DADS0680 Each DADS shall have the capability to support all required requests and shall grow as demand expands.~~

DELETED -- Subsumed by DADS3135 and DADS3090

DADS0690 Each DADS shall support the prioritized retrieval and delivery of data based on the priority information specified in the data retrieval request.

DADS0700 Each DADS shall be capable of reacting to data transfer cancellation or delay notifications ~~from the IMS~~.

~~DADS0710 Each DADS shall maintain a data distribution log.~~

MOVED -- Moved to DADS1110

7.5.1.5.2.3.3.2 ~~Retrieve from Archive~~ <<Not Used>>

~~DADS0720 Each DADS shall provide the capability of retrieving any data granule stored in the archives.~~

MOVED -- Moved to DADS1806

7.5.1.5.2.3.3.3 Subset

DADS0730 Each DADS shall provide a capability for performing selected, non-routine data transformations using ~~requestor~~ approved algorithms.

DADS0740 Each DADS shall provide the capability to subset, subsample, or average data within a granule based on defined criteria to include:
a. Geographic location (x, y, z) (spatial with rectangular ~~bands~~ **boundaries**)
b. Spectral band
c. Time

7.5.1.5.2.3.3.4 Reformat

DADS0760 The DADS shall distribute data in ~~approved~~ **the following** standard formats**:**
a. ECS standard format (HDF)
b. TBR

DADS0770 The DADS shall reformat data sets **in one of the following standard formats**: ~~according to requests.~~
a. ECS standard format (HDF)
b. TBR

DADS0780 Each DADS shall have the capability to incorporate new ingest and data distribution formats and conversion software.

DADS0800 Each DADS shall provide the capability to translate **the following** input data to the internal ECS format**: TBR**

7.5.1.5.2.3.3.5 Generate Statistics

DADS0880 For data which it has distributed, each DADS, via the LSM, shall generate required ~~billing~~ **accounting** information.

DADS0890 Each DADS shall generate resource utilization statistics (accounting data) as input to the billing process. The statistics include at a minimum:
a. Standing order / data distribution request number
b. Media cost
c. CPU utilization

d. I/O utilization
e. Personnel costs
f. Shipping/handling
g. Networking cost
h. Archival storage cost

~~DADS0900 Each DADS shall send, via the LSM, accounting data to the SMC.~~

DELETED -- replaced by DADS0901

DADS0901 The DADS element shall collect the management data used to support the following system management functions:

a. Fault Management
b. Configuration Management
c. Accounting Management
d. Accountability Management
e. Performance Management
f. Security Management
g. Scheduling Management

7.5.1.5.2.3.3.6 Send/Receive Status

~~DADS0910 Each DADS shall notify the SMC and IMS in the event that data required in connection with an on-demand request does not arrive.~~

MOVED -- Moved to PGS-0255

~~DADS0925 Each DADS shall, in the event of noncompliance (e.g., non-arrival of scheduled data) forward a description of noncompliance to the SMC.~~

MOVED -- Moved to PGS-0256

DADS0927 Each DADS shall ~~generate and~~ send to ~~SMC~~ LSM reports of the status of the distribution of data.

DADS0930 Each DADS shall provide the IMS an estimate of the staging delay before subsetted, subsampled, or summary data sets are available.

DADS0940 Each DADS shall ~~receive~~ **send distribution status to the IMS in response to** distribution status requests from the IMS.

DADS0960 Each DADS shall automatically send data distribution status to the IMS upon completion of the distribution process.

DADS1000 ~~Each~~ **The** DADS shall receive **distribution status requests** from the collocated PGS.~~ distribution status requests in order to track the status of a data distribution request, which shall contain the following information (specific content and format) at a minimum:~~

~~a. Requestor identification~~
~~b. Job identification~~
~~c. Date and time~~

DADS1010 Each DADS shall send to the ~~PGS~~ **requestor**, staging status of requests for retrieval of data products.

DADS1020 Each DADS shall generate data retrieval status to acknowledge the receipt of a product order. The data retrieval status shall indicate the acceptance or rejection of the request. In the event of rejection, the status shall contain an indication of the reason for rejection (i.e., distribution parameters missing, data not present or unreadable~~, etc.~~).

DADS1030 Each DADS shall generate data distribution status to monitor the progress of the distribution process.

DADS1070 The DADS shall send ~~QA~~ **data check** and storage status to the provider of ~~the~~ **ingest** data.

7.5.1.5.2.3.3.7 ~~Update Inventory~~ Data Logs

DADS1080 Each DADS shall maintain a data receipt log.

DADS1085 Each DADS shall maintain a data access log ~~in order to generate data retrieval reports~~.

MOVED -- Moved from DADS1490

~~DADS1090 Each DADS shall update internal file directories with the unique Data set ID provided by the PGS.~~

MOVED -- Moved to DADS1795

DADS1100 Each DADS shall maintain a log of all updates to the local inventory. The log shall be used to generate status reports and, in conjunction with the inventory backup, recreate the local inventory in the event of catastrophic failure.

DADS1110 Each DADS shall maintain a data distribution log.

MOVED -- Moved from DADS0710

DADS1114 Each DADS shall maintain a ~~database~~ **log** of staging ~~directives~~ **activity.**

MOVED -- Moved from DADS1270

~~DADS1120 Each DADS shall maintain data storage inventories defining the physical location of files.~~

MOVED -- Moved to DADS1800

~~DADS1140 The DADS shall provide an inventory system capable, at a minimum, of the following:~~

~~a. Accepting the number of new inventory entries, one per granule, for the number of granules per day as specified in Appendix C~~
~~b. Uniquely identifying each data granule~~
~~c. Tracking the physical location of each data granule~~

MOVED -- Moved to DADS1805

7.5.1.5.2.3.3.8 Update Metadata

~~DADS1150 Each DADS shall generate metadata for data transferred to another location.~~

DELETED -- Subsumed by DADS1160.

DADS1160 Each DADS shall provide the IMS with metadata reflecting changes as a result of:

a. Purges
b. Transfers **to other site(s)**
c. Unexpected loss
d. Updates

7.5.1.5.2.3.3.9 Staging

~~DADS1170 Each DADS shall maintain a list of products requiring QA by SCF or the PGS.~~

MOVED -- Moved to PGS-1175

DADS1180 Each DADS shall provide the collocated PGS with data storage and retrieval capabilities.

~~DADS1190 Each DADS shall send to the designated PGS, at a minimum :~~

~~a. L0-L4 data sets in response to a data products request or a QA product request~~
~~b. Non-EOS science data~~
~~c. Ancillary data sets~~
~~d. Quick-look data~~
~~e. Algorithms~~

DELETED -- Subsumed by DADS2330

DADS1210 Each DADS shall prepare, for output to the collocated PGS, data availability notices.

~~DADS1230 Each DADS shall receive from the collocated PGS storage directives for the temporary storage of data products. which shall contain the following information at a minimum:~~

~~a. Product/data set identification~~
~~b. Storage directive:~~
~~1. Move (archive and delete from temporary storage)~~
~~2. Copy (archive but keep in temporary storage)~~
~~3. Delete (delete from temporary storage)~~

DELETED -- design detail

~~DADS1250 Each DADS shall, in response to a QA product request from SCF, transmit the specified products and associated metadata to the SCF for QA approval.~~

DELETED -- Subsumed by DADS2380

~~DADS1260 Each DADS shall send special algorithms to the SCF.~~

DELETED -- Subsumed by DADS2380

~~DADS1270 Each DADS shall maintain a database of staging directives.~~

MOVED -- Moved to DADS1114

7.5.1.5.2.3.4 Manage System

7.5.1.5.2.3.4.1 System Faults

~~DADS1280 Each DADS shall detect, via the LSM, all DADS processing system faults.~~

DELETED -- Subsumed by SMC-4315

~~DADS1300 Each DADS shall display, via the LSM, all faults to the system operators.~~

DELETED -- Subsumed by SMC-2105

DADS1310 Each DADS shall report ~~, via the LSM,~~ detected processing system faults to the **LSM** ~~SMC by including them in the DADS status report~~.

DADS1320 Each DADS shall provide ~~, via the LSM,~~ fault isolation information at the ~~system and~~ subsystem levels **to the LSM.**

DADS1330 Each DADS shall provide~~, via the LSM,~~ information to support fault isolation between the DADS and other ~~EOSDIS~~ **ECS**-unique elements and external interfaces **to the LSM.**

~~DADS1340 Each DADS shall use tools to analyze system performance.~~

DELETED -- Subsumed by SMC-3385

7.5.1.5.2.3.4.2 Media

DADS1350 Each DADS shall manage its storage media to eliminate data loss due to long or short term media degradation~~, adhering to standards and practices defined by NARA, NIST, and NASA.~~ **in accordance with the following standards: (TBR)**

DADS1360 Each DADS shall monitor the status, cost, and performance of all storage systems used.

DADS1370 Each DADS shall provide a mechanism for statistically monitoring the bit error rate (BER) of storage media in the archive.

DADS1375 Each DADS shall provide automatic management and copying/refresh of archive media.

MOVED -- Moved from DADS3010(2)

7.5.1.5.2.3.4.3 Data Transfer

~~DADS1380 Each DADS shall monitor data transfer between external (non-EOS) elements and the DADS.~~

DELETED -- Subsumed by SMC-6335

~~DADS1390 Each DADS shall monitor data transfer between elements of the EOSDIS and the DADS.~~

DELETED -- Subsumed by SMC-6335

DADS1400 Each DADS shall notify the originating source of the need to retransmit data in the event of transmission difficulties.

7.5.1.5.2.3.4.4 General

DADS1450 Each DADS shall be capable of screening its archive holdings of Level 1A or Level 0 data, and if a product(s) is found to be lost or unreadable, generate a request for a replacement product from EDOS, dispatch the request, and ingest the replacement product.

MOVED -- Moved from DADS0495

~~DADS1460 Each DADS shall track and report problems to SMC.~~

DELETED -- Subsumed by DADS1310

DADS1470 Each DADS shall manage element resource utilization.

DADS1475 Each DADS shall provide ~~the following toolkits to the users~~ **tools to the users to perform**:

a. Format conversion of EOS data
b. Subsetting
c. Compression (lossy, lossless)
d. Data transformation
e. ~~Graphic display~~
f. Subsampling

DELETED -- Deleted item (e). Subsumed by IMS-1510

~~DADS1480 Each DADS shall be capable of providing the SMC with the following, at a minimum:~~

~~a. User request status~~
~~b. Data volume~~

c. ~~Backlog data requests~~
d. ~~DADS performance~~
e. ~~Data distribution log~~
f. ~~Returned media accounting report~~
g. ~~Security audit log~~
h. ~~DADS resource utilization~~
i. ~~Schedules~~

DELETED -- Subsumed by DADS0901

~~DADS1490 Each DADS shall maintain a data access log in order to generate data retrieval reports.~~

MOVED -- Moved to DADS1085

~~DADS1500 Each DADS shall generate data retrieval reports for DADS management.~~

DELETED -- Subsumed by SMC-8705

DADS1510 Each DADS shall ~~provide the capability for operations personnel to monitor a log of all metadata not stored in the IMS and initiate corrective action to assure storage of the metadata. Corrective action shall include the manually initiated retransmission of the metadata.~~**ensure that products stored in the DADS have corresponding metadata in the IMS.**

7.5.1.5.2.3.4.5 File and Storage Management System (FSMS)

DADS1520 Each DADS shall provide an FSMS. Storage shall be based on a hierarchy of devices and media, with location-transparent access to the files.

DADS1530 Each DADS shall maintain a ~~Master File Directory(MFD)~~ **file directory** of all files under its control.

DADS1540 In case of corruption or catastrophic failure, capabilities for recovering the ~~MFD~~ **file directory** shall be provided.

DADS1550 Operations/systems personnel shall be able to access, list, or modify the contents of the ~~MFD~~ **file directory** in a special privileged mode.

~~DADS1590 File transfer shall be accomplished using, for example, the DoD Internet File Transfer Protocol (FTP) as described in RFC 959, or its equivalent under OSI, with the intention to be in compliance with GOSIP. All client and server functions shall be implemented.~~

DELETED -- Subsumed by ESN-0180.

DADS1610 The FSMS shall provide for continued performance, albeit in a degraded mode, when a device (disk or cartridge drive, operator's console~~, etc.~~) fails.

DADS1620 At each DADS tools shall be available for operations/ systems/ maintenance personnel to monitor performance, carry out maintenance, and alter operating parameters.

DADS1630 At each DADS tools shall be provided for recovery of data from failed media and devices.

DADS1640 ~~At each~~ **The** DADS~~, the FSMS~~ shall support the ~~large~~ number of files derivable from Appendix C, with the ability to expand to match growth.

DADS1700 Where appropriate, the FSMS at each DADS, shall comply with the evolving guidelines of the IEEE-CS MS Reference Model.

DADS1780 Each DADS shall provide the capability to store as a single entity logically grouped sets of data.

DADS1790 Each DADS shall periodically verify that all data sets are present and accounted for.

DADS1791 Each DADS shall have the capability to mount archival media via automated means.

MOVED -- Moved from DADS2940

DADS1795 Each DADS shall update internal file directories with the unique Data set ID ~~provided by the PGS~~.

MOVED -- Moved from DADS1090

DADS1800 Each DADS shall maintain data storage inventories defining the physical location of files.

MOVED -- Moved from DADS1120

DADS1805 The DADS shall provide an inventory system capable, at a minimum, of the following:

a. Accepting the number of new inventory entries, one per granule, for the number of granules per day as specified in Appendix C
b. Uniquely identifying each data granule
c. Tracking the physical location of each data granule

MOVED -- Moved from DADS1140

DADS1806 Each DADS shall provide the capability of retrieving any data granule stored in the archives.

MOVED -- Moved from DADS0720

7.5.1.5.2.3.4.6 Data Restoration

DADS1810 Each DADS shall provide a media replacement capability ~~which is compliant with NARA, NIST, and NASA standards~~ for media which ~~does not meet these~~ **is not compliant with the following** standards~~.~~**:**

TBR

7.5.1.5.2.3.4.7 ~~Hierarchical Storage~~ <<Not Used>>

~~DADS1830 Each DADS shall store data using a multi-level storage hierarchy scheme, where each level of the hierarchy contains appropriate capacity to respond to contingencies, scheduling problems, and peak loads. (The different levels possess varying degrees of access speed, storage capacity, and cost, which may be used to optimize system performance.)~~

DELETED -- This level of detail should be left to design trade-off.

~~DADS1840 Each DADS shall utilize an automated process for migrating data between the levels of the storage hierarchy.~~

DELETED -- This level of detail should be left to design trade-off.

7.5.1.5.2.3.4.8 Configuration Management

~~DADS1850 Each DADS shall implement the configuration management toolkit specified by the SMC.~~

DELETED -- Subsumed by SMC-2515

~~DADS1860 Each DADS shall provide configuration management for its internal resources.~~

DELETED -- Subsumed by SMC-2510

7.5.1.5.2.3.4.9 Scheduling

~~DADS1950 Each DADS shall access, via the system database at the SMC, the allocation of ground event functions and capabilities to each site/element.~~

MOVED -- Moved to PGS-0005

~~DADS1960 Each DADS shall access, from the SMC via the system database, the priorities used in scheduling ground events.~~

MOVED -- Moved to PGS-0010

~~DADS1970 Each DADS shall access from the SMC, via the system database, the product thread information for each standard and quick-look product generated by EOSDIS.~~

MOVED -- Moved to PGS-0015

~~DADS1980 Each DADS shall receive from the SMC scheduling directives for system level, site/element-to-site/element, testing, and simulation activities.~~

MOVED -- Moved to PGS-0020

~~DADS2000 Each DADS shall receive from the SMC scheduling directives in response to emergency situations.~~

MOVED -- Moved to PGS-0030

~~DADS2010 Each DADS shall receive from the SMC schedule adjudication directives.~~

MOVED -- Moved to PGS-0040

DADS2020 Each DADS shall receive data availability schedules from: ~~EDOS, and the IPs.~~

a. EDOS
b. IPs
c. ADCs
d. ODCs
e. Remote DADS
f. TRMM (Pacor)

~~DADS2030 Each DADS shall maintain a list/schedule of data to be received from EDOS.~~

MOVED -- Moved to PGS-0050

~~DADS2040 Each DADS shall insure that data sent by EDOS has been received and validated.~~

MOVED -- Moved to PGS-0060

~~DADS2050 Each DADS shall have a means to obtain a list/schedule of L0 data to be transmitted by EDOS.~~

DELETED -- Subsumed by DADS2020

DADS2060 Each DADS shall~~, based on its schedules,~~ communicate with the EDOS to indicate ~~its~~ **the SDPSs** readiness to accept data.

~~DADS2070 Each DADS shall interact with EDOS and SMC to resolve schedule conflicts.~~

MOVED -- Moved to PGS-0080

~~DADS2080 Each designated DADS shall receive standing and retrospective product orders from the IMS.~~

MOVED -- Moved to DADS0498

~~DADS2090 Each DADS shall reevaluate its schedule after receiving new orders from the IMS.~~

DELETED -- Subsumed by PGS-0160 and PGS-0190

~~DADS2100 Each DADS shall receive time windows and priorities requested by the user for incorporation into and modification of its schedule.~~

DELETED -- Subsumed by PGS-0160 and PGS-0190

~~DADS2110 The LSM located at each DADS shall serve as a window through which the SMC can gain access to and receive scheduling information.~~

MOVED -- Subsumed by PGS-0325

~~DADS2120 The LSM located at each DADS shall serve as a window through which each element's scheduling function has access to the system wide scheduling information. Such information includes, at a minimum, ESDIS Policies and Procedures regarding instrument and ground event scheduling, other element plans and schedules, element allocations of ground event functions and capabilities, product thread information, and scheduling directives for testing, maintenance, and emergency situations.~~

MOVED -- Moved to PGS-0090

~~DADS2130 The LSM located at each DADS shall serve as the window through which operations and management staff can communicate scheduling information to and from the SMC. Such scheduling information includes, at a minimum, information for routine scheduling, request scheduling, schedule conflict alert, and emergency scheduling.~~

DELETED -- Subsumed by SMC-1305 and SMC-1315

~~DADS2140 The LSM located at each DADS shall have the capability to automatically extract, process, and send to the SMC, pertinent scheduling information.~~

DELETED -- Subsumed by DADS0901

~~DADS2150 The LSM located at each DADS shall perform priority management services to resolve schedule conflicts.~~

DELETED -- Subsumed by SMC-1500

DADS2160 Each DADS shall maintain a list ~~/schedule~~ of standing orders.

DADS2170 Each DADS shall maintain a list ~~/schedule~~ of retrospective orders.

DADS2180 Each DADS shall maintain a list ~~/schedule~~ of reprocessed data.

DADS2190 Each DADS shall maintain a list ~~/schedule~~ of products which could not be delivered electronically (e.g., workstation off-line).

DADS2200 Each DADS shall maintain a list ~~/schedule~~ of data which requires some form of data manipulation such as subsetting.

~~DADS2210 Each DADS shall provide tools for the creation and manipulation of its plans/schedules.~~

DELETED -- Subsumed by PGS-0140.

~~DADS2220 Each DADS shall provide tools for manually overriding any of its schedules with other elements.~~

DELETED -- Subsumed by PGS-0140.

DADS2230 Each DADS shall inform the collocated PGS of any anticipated resource availability conflicts.

~~DADS2240 Each DADS shall receive from its collocated PGS requests for data required for the processing of products.~~

DELETED -- Subsumed by DADS0520.

~~DADS2250 Each DADS shall coordinate and resolve schedule conflicts with its collocated PGS .~~

MOVED -- Moved to PGS-0100.

~~DADS2260 Each DADS shall provide tools to automate the creation/generation of schedules between the DADS and its collocated PGS.~~

DELETED -- Subsumed by PGS-0140

7.5.1.5.2.3.4.10 Backup

DADS2270 Each DADS shall provide ~~safe storage for~~ **an off-site backup copy of** all EOS data which would be impossible or difficult to recover in case of loss ~~(e.g., ancillary data, metadata, command history, algorithms, engineering data, calibration data, systems and applications software, selected data products, depending on need~~).

DADS2276 Each DADS shall ~~ensure that~~ **have** the capability to ~~backup its archive is in place, by storing a backup copy of data and products, or a single copy and all information required to regenerate products if that copy is lost, or a combination of the two approaches.~~ **restore its archive.**

MOVED -- Moved from DADS0485

~~DADS2290 Each DADS shall store the backup copy in a separate, safe location.~~

DELETED -- Subsumed by DADS2270

DADS2300 At each DADS backup shall ~~be~~ **provide** a capability which allows for the system dump/restore of on-line system and user files, as well as specified files.

MOVED -- Moved from DADS3030

~~DADS2305 DADS shall have the capability to generate requests for L0 data from the backup inventory at EDOS.~~

DELETED -- Subsumed by DADS1450

DADS2307 DADS shall ~~have the capability to respond to~~ **fulfill** requests for L0 data from EDOS ~~for recovery purposes, fulfilling those requests~~ with L0 or L1A data, as available.

7.5.1.5.2.3.5 Distribution

7.5.1.5.2.3.5.1 Send Data

~~DADS2310 Each DADS shall make its status available to the SMC via the LSM.~~

DELETED -- Subsumed by DADS0901

DADS2315 Each DADS shall be capable of providing access to data to support the instrument science team(s) in:
- **a. Pre-launch checkout of their instruments**
- **b. Pre-launch science checkout**
- **c. Development of initial calibration information.**

MOVED -- Moved from part of DADS0280.

DADS2320 Each DADS shall send to the IMS, at a minimum, the following:
- a. Metadata
- b. Documentation
- c. Product status dialog

DADS2330 Each DADS shall send to the PGS, at a minimum, the following:
- a. ~~Production data (L0) received from EDOS~~
- b. L0-L4
- c. Quick-look data
- d. Metadata
- e. Ancillary data
- f. Calibration data
- g. Algorithms
- h. Schedules
- i. Status
- j. Spacecraft and instrument logs
- **k. Special data sets**

DADS2340 Each DADS shall send to remote DAACs, at a minimum, the following:
- a. L0-L4
- b. Metadata
- c. Ancillary data
- d. Calibration data
- e. Correlative data
- f. Documents
- g. Algorithms
- h. Spacecraft and instrument logs

DADS2345 Each DADS shall send to ADCs, at a minimum, the following:
- a. L0-L4
- b. Metadata
- c. Ancillary data
- d. Calibration data
- e. Correlative data
- f. Documents

g. Algorithms
h. Spacecraft and instrument logs

DADS2350 Each DADS shall send to the ICC, at a minimum, processed quick-look products.

DADS2360 Each DADS shall send to the ODCs, at a minimum, the following:
a. L0-L4
b. Special products (L1-L4)
c. Metadata
d. Ancillary data
e. Calibration data
f. Correlative data
g. Documents
h. Algorithms

DADS2370 Each DADS shall send to the user, at a minimum, the following:
a. L0-L4
b. Special products (L1-L4)
c. Metadata
d. Ancillary data
e. Calibration data
f. Correlative data
g. Documents
h. Algorithms
i. Planning and scheduling information

DADS2380 Each DADS shall send to the SCF, at a minimum, the following:
a. L0-L4
b. Special products (L1-L4)
c. Metadata
d. Ancillary data
e. Calibration data
f. Correlative data
g. Documents
h. Algorithms

DADS2390 Each DADS shall send to the IPs, at a minimum, the following:
a. L0-L4
b. Metadata
c. Ancillary data
d. Calibration data
e. Correlative data
f. Documents

~~DADS2400 Each DADS site shall be capable, with IMS coordination, of receiving data from and distributing data to each of the other DADS sites.~~

DELETED -- Subsumed by DADS0140 and DADS2340

DADS2410 Each DADS shall ~~retrieve and~~ distribute data from the archive in response to receipt of a product order from the IMS.

DADS2430 Each DADS shall be capable of distributing any data granule stored in the archive.

DADS2440 Each DADS shall distribute data under a multi-level priority system. ~~For example:~~

~~a. Quick-look data~~
~~b. QA data~~
~~c. Data products requested by standing order~~
~~d. Data products requested retrospectively~~

DADS2450 Each DADS shall distribute data to elements of EOSDIS and approved non-EOSDIS data destinations.

DADS2460 Each DADS shall have a manual override function capable of altering the priority of ~~the~~ **a** distribution ~~queue~~ **request.**

DADS2470 Each DADS shall transfer Standard Products and subsetted, subsampled, or summary data to the requester.

DADS2480 Each DADS shall distribute data based upon entries in the standing and the retrospective order distribution list.

7.5.1.5.2.3.5.2 Write to Variety of Physical Media

DADS2490 Each DADS shall distribute data ~~using a variety of~~ **on the following** approved high density storage media~~.~~ **:**

a. 8 mm tape
b. 4 mm DAT
c. 6250 bpi tape
d. CD ROM

~~DADS2500 Each DADS shall copy data sets to appropriate media for distribution.~~

DELETED -- Subsumed by DADS2490

DADS2510 Each DADS shall copy data to the class of ~~storage~~ **physical** media specified in the product order from the IMS.

~~DADS2530 The DADS shall be capable of distributing by physical media (e.g., magnetic tape, optical disk, optical tape, microfilm) to meet user demand.~~

DELETED -- Subsumed by DADS2490

~~7.5.1.5.2.3.5.3 Package and Address~~ <<Not Used>>

~~DADS2550 Upon receipt and approval of a request, the designated DADS shall make stored data products available for delivery to the requestor within 24 hours for data distributed on physical media.~~

MOVED -- Moved to DADS2770

7.5.1.5.2.3.5.4 Distribute to Networks

DADS2580 Each DADS shall distribute data electronically using a variety of networks and methods including FAX **(standard TBR)**.

~~DADS2620 Each DADS shall provide archived data defined to the PGS.~~

DELETED -- Subsumed by DADS2330

~~DADS2630 Each DADS shall be capable of making quick-look products available for distribution within 1 minute of receipt from the PGS.~~

MOVED -- Moved to DADS3115

~~DADS2640 Each DADS shall distribute product QA data produced at the collocated PGS within 1 hour from the time it is ready.~~

MOVED -- Moved to DADS3120

~~DADS2660 Each DADS shall make archive data requested for communications network delivery available to the network within an average of 2 minutes after the receipt of a request for that data.~~

MOVED -- Moved to DADS3125

~~DADS2670 The DADS shall be capable of transmitting data over communications network, in support of data distribution requests, at the data rates specified in Appendix C.~~

MOVED -- Moved to DADS3130

DADS2675 Each DADS shall ~~maintain a log of all transmission problems and~~ institute corrective measures when network performance begins to impact distribution effort adversely.

7.5.1.5.2.4 DADS Performance

DADS2770 Upon receipt and approval of a request, the designated DADS shall make stored data products available for delivery to the requestor within 24 hours for data distributed on physical media.

MOVED -- Moved from DADS2550

DADS2778 Each DADS shall be capable of receiving and archiving three days' worth of data (see Appendix C) in any given day.

MOVED -- Moved from DADS0090.

~~DADS2780 Each DADS shall be capable of ingesting data at the maximum output bandwidth of the EDOS.~~

MOVED -- Moved to PGS-1305

~~DADS2790 Each DADS shall be capable of processing, for storage and retrieval, real and simulated EOS instrument data in support of pre-launch checkout of the ground system.~~

MOVED -- Moved to DADS0282

DADS2900 Each DADS shall provide archival capacity for current volume requirements plus one year. Volume requirements are specified in Appendix C.

DADS2910 Archival storage at each DADS shall be field-expandable.

~~DADS2940 Each DADS shall have the capability to mount archival media via automated means.~~

MOVED -- Moved to DADS1791

~~DADS2950 In case of failure of the automated system, archive media must be capable of being manually mounted at each DADS.~~

DELETED -- Subsumed by DADS0435

~~DADS2990 At each DADS a minimum of two paths shall be provided for the archival system of each storage type.~~

DELETED -- Subsumed by EOSD3920

DADS3000 ~~At each DADS hardware and/or microcode error detection and correction shall be provided to ensure archival data integrity. The~~ **To support archival data integrity, the** bit error rate after correction shall be less than 1 in 10^{12}.

DADS3010(1) Archival and backup media at each DADS shall ~~be compliant with NARA, NIST, and NASA standards and~~ have a rated shelf life of at least 10 years when stored in a controlled environment.

MODIFIED -- deleted portion subsumed by DADS0425

~~DADS3010(2) Each DADS shall provide automatic management and copying/refresh of archive media.~~

MOVED -- Moved to DADS1375

~~DADS3020 At each DADS operations personnel shall be able to add new physical volumes and eject physical volumes from the archive for off-line or off-site permanent storage.~~

MOVED -- Moved to DADS0435

~~DADS3030 At each DADS backup shall be a capability which allows for the system dump/restore of on-line system and user files, as well as specified files.~~

MOVED -- Moved to DADS2300

~~DADS3040 At each DADS backup media shall be removable from the DADS site (e.g., for safe off-site storage).~~

DELETED -- Subsumed by DADS2270

~~DADS3055 At each DADS all backup media shall be capable of being mounted automatically where appropriate, with the provision for manual failover.~~

DELETED -- limits design choices

DADS3090 Each DADS shall be capable of 200% expansion in throughput and archive capacity without architecture or design change. This expansion capacity shall apply to the total of the at-launch requirement plus the yearly growth requirement specified in Appendix C.

DADS3100 Each DADS shall be capable of providing data for daily distribution via communications network at a rate equivalent to daily product volume.

DADS3110 Each DADS shall be capable of distributing data via physical media at a rate equivalent to the rate data are ingested at that DADS.

DADS3115 Each DADS shall be capable of making quick-look products available for distribution within 1 minute of receipt from the PGS.

MOVED -- Moved from DADS2630

DADS3120 Each DADS shall distribute product QA data produced at the collocated PGS within 1 hour from the time it is ready.

MOVED -- Moved from DADS2640

DADS3125 Each DADS shall make **unmodified-**archive data requested for communications network delivery available to the network within an average of 2 minutes after the receipt of a request for that data.

MOVED -- Moved from DADS2660

DADS3130 The DADS shall be capable of transmitting data over communications network, in support of data ~~distribution~~ **production** requests, at the data rates specified in Appendix C.

MOVED -- Moved from DADS2670

DADS3135 The DADS shall have the capability to support the transaction rate as specified in Table 7.5.2.4-1.

7.5.1.5.2.5 Application Programming Interfaces (APIs)

DADS3140 The DADS shall be developed with configuration-controlled application programming interfaces (APIs) that will be capable of supporting development of DAAC-unique data ingest services operated independently of the delivered ECS DADS services.

DADS-3150 The DADS shall be developed with configuration-controlled application programming interfaces (APIs) that will be capable of supporting development of DAAC-unique data distribution services operated independently of the delivered ECS DADS services.

DADS3160 The DADS shall be developed with configuration-controlled application programming interfaces (APIs) that will be capable of supporting development of an operator interface that may bypass the delivered DADS operator interface.

7.5.2 Information Management System (IMS)

7.5.2.1 Overview

The Information Management System element provides the interface between the ECS users and the ECS information management functions. A primary role of the IMS is to give the users efficient access to the ECS data products, providing them with all of the information and tools to search, locate, select, and order those products required to perform their science investigations. These products may be stored in the archives or may entail either higher level processing of an archived product or the placement of an acquisition and processing request. The IMS will also assist the users in locating and ordering non-ECS data from ADCs and other cooperating data centers.

In addition to providing users with information on data products, the IMS will also provide access to other information required by the users. This will include general mission information, algorithm descriptions, accounting information, and the status of any requests that the scientists have submitted to the system. The sources, and in some cases the maintenance of these information bases will be distributed among the other ECS components including the SMC, the EOC , and the DAACs, as well as the EOS scientists themselves. The challenge of the IMS is the development of innovative methods to capture, manage, and provide effective access to this large and diverse set of information.

The IMS services will be distributed among the ECS DAACs so as to provide local information management capabilities at each of the DAACs. The functional capabilities that will be provided by the IMS have been aggregated into the following service categories:

- System Access and User Registration
- Information Management
- Information Search and Browse
- Archival Product Requests
- Data Processing Requests
- Data Acquisition Planning and Request Submittal
- Data Request Routing and Tracking
- Cost Estimation and Account Status Interface
- Toolkit Services

- **Access to** Communication Services
- ~~Local System Management (internal service)~~**Statistics Collection for Local Systems Management**

7.5.2.1.1 System Access and User Registration

The IMS will provide access to all ECS services from any of the ECS access nodes (DAACs). At each of the access nodes, the user will have access to the full range of services, spanning the whole of EOSDIS, including data and services available from all DAACs, ADCs, and ODCs. The IMS will provide a mechanism by which a new user can complete an account application which is then forwarded to the SMC. During the log-on procedure, the users will be verified against a data base that checks their access privileges and will also activate and update their user profile to facilitate their operations during the on-line session. A user interface will outline the EOSDIS services that are available to the user and help facilities will assist in accessing the capabilities. The interface will be flexible enough to easily accommodate the entire range of possible users, from the novice who will need considerable help in using the system to the experienced user who will want to access the system capabilities as directly and efficiently as possible.

7.5.2.1.2 Information Management

A basic service that the IMS will provide to support all of its user applications is the management of EOSDIS information. The most voluminous part of this information will be that which describes the ECS and non-ECS data products that are available through the system, but it will also include system, mission, instrument, and algorithm documentation, publications, EOC instrument and spacecraft historical data, spacecraft housekeeping and ancillary data information, and acquisition and processing schedules. The IMS will access data bases maintained by other ECS elements, as needed. Where information is to be exchanged with other elements, ADCs, or ODCs, it will conform to established interface standards. Such information may be forwarded directly to a user or to a DADS. ~~Once data is archived in a DADS, whether it was generated by EOS instruments or not, it is considered ECS data.~~

The metadata will be designed to support complex multi-disciplinary and multi-instrument data searches by both novices and experienced users. It will contain sufficient information on each data granule to allow users to select only those instances that are of use or interest. It will also permit the search for data across data sets at distributed active archives for coincident occurrences in space or time. The metadata will be organized in some hierarchy that allows the users to narrow their search from general information queries to those that permit the identification of those granules with specified attributes. The information required will range from overall data set descriptions to the specific coverage and content of individual granules.

7.5.2.1.3 Information Search and Browse

The information search service supports the identification and selection of data products and access to other auxiliary information that is maintained by the IMS. The interface will provide the capability to easily construct complex queries that allow the users to locate their data of interest. A directory will provide access to the general data set information of ECS and non-ECS data, an inventory will provide access to that information that describes individual data granules, and a ~~catalog~~ **guide** will provide access to documentation and reference materials about data sets. In addition to selecting data on the basis of the information contained in the data bases, the system will permit the users to browse subsetted, subsampled and summarized data sets which are created during routine production processing and on-demand in response to user requests. Data sets for browsing will be generated by scientist provided algorithms.

In addition to supporting the search for data, this service will allow the users to search through the collection of mission, instrument, algorithm software, metadata format standards, data format standards, and ESDIS Project policy and procedure information. Access to information on acquisition and processing schedules and status information that pertains to product requests will be provided to users.

Users will be able to view information on the Science Processing Library holdings and order the software via the IMS. The Science Processing Library contains a baseline set of software routines that perform common science data processing functions required for data product generation and quality assessment.

7.5.2.1.4 Archival Product Requests

Following the identification of data granules of interest, the IMS will assist the users in creating and submitting a request for the products. A request form will be filled out by the user with the assistance of system prompts. The user profile will also be used to assist in the process by providing user background information as default entries on the forms. Archival products that may be requested will include EOS products from U.S. and IP spacecraft and instruments, and ADC and ODC data, where data exchange agreements have been established.

7.5.2.1.5 Data Processing Requests

In some cases, the user may require higher level Standard Products that have not been generated and archived by the system. The IMS will present the data processing options to the users and will assist the user in setting up a processing request to be submitted to the system. As with the product requests, the user's profile will be used to facilitate the process and the IMS will check the request to ensure that it is reasonable and within the privileges and resources of the investigator.

7.5.2.1.6 Data Acquisition Planning and Request Submittal

The user will also be able to construct and submit requests for future data acquisitions through the IMS. The system will provide the users with access to the long-term and short-term schedules to make them aware of the current EOS plans for acquiring data and the existing list of Data Acquisition Requests (DARs) that have been submitted, but not yet scheduled. After reviewing this information, if the user does wish to submit a new DAR, the IMS will provide the tools to specify the instrument and instrument parameters and the time and location of the acquisition. Again, the user's profile will be used to assist in the construction of the request and the system will perform a reasonability check of the request to improve the probability that the request will be approved.

7.5.2.1.7 Data Request Routing and Tracking

For each product, processing, and acquisition request that is submitted by the user, the IMS will parse the request into its components and route them to the appropriate ECS elements. The decomposed requests may go to different elements with interdependencies; therefore, the IMS will determine the sequence of the operations following the directives installed at the SMC and will include a requested time window with each step of the request. It is assumed that each algorithm and processing procedure has been previously installed at the active archives. As an example, a processing request may entail the retrieval of lower level products from multiple DADS followed by their delivery to a PGS for processing. The time windows will ensure that the individual steps will be accomplished within the overall time limit of the request.

Once the elements have received the parsed requests, they will be responsible for scheduling the actual processing. If they have a conflict that prevents them from completing the task within the specified time window, they will return a conflict alert to the IMS. The IMS will inform the user of the conflict and the resubmission options that are available in an attempt to resolve it. Conflicts that cannot be resolved at that level will be forwarded to the SMC for anal adjudication.

7.5.2.1.8 Cost Estimation and Account Status Interface

The IMS will perform two primary tasks within the cost estimation and billing services. When the users are constructing requests, the IMS will calculate and provide an estimate of the resources that will be expended in satisfying the request. These will be based on estimation algorithms provided by the SMC and are intended to assist the users in refining their requests and allow the system to verify that the user has access to the required resources. The actual cost accounting functions will be performed by the SMC. The IMS will also serve as the users' interface to their accounts, which will be maintained by the SMC. Users will be able to check their account activity and balances using IMS services.

7.5.2.1.9 Toolkit Services

The IMS will provide the software needed to integrate the DADS, ESN, ICC, PGS, IMS, and SMC element toolkits into a cohesive package which is accessible via a common user interface. ~~In addition, the IMS will automatically distribute the toolkits and toolkit upgrades to users authorized by the appropriate elements and administer licenses for any COTS products involved.~~ The configuration of toolkits for a particular installation is tailored to the user's site-specific requirements and responsibilities for the EOS mission. The toolkit software for each element will be able to display interrupt messages from the ICC and EOC in real time.

The overall functions of the element toolkits are summarized below. Specific requirements for the toolkits are given within each element's section of this document.

The DADS toolkit will provide tools for data format conversion of EOS data, data product subsetting and subsampling, lossy and lossless data compression, and data transformation.

In addition, an ESN toolkit is required for communications and services that will provide compatibility with ESN and ECS. The toolkit for network communications and services will consist of ~~GOSIP/ISO~~ **communication** protocols, network management and maintenance, process to process communications, electronic mail/message handling, virtual terminal support, file transfer and management, window managers, directory services, and network security and access control.

PIs and TLs will be able to remotely access the ICC operating their instrument through an ICC toolkit hosted locally. This software toolkit will provide a subset of the capabilities available at the ICC, and will enable the PI/TL to participate in planning and scheduling of instrument operation as well as monitoring the performance of the instrument based on actual instrument engineering data and science quick-look data or other status information provided by the ICC. The PI/TL will also be able to submit command requests to the ICC.

The PGS toolkit will provide scientists with tools needed to simulate the operation of their algorithms in the production environment of the PGS. The toolkit will provide file access, job control, error logging, dynamic storage allocation, and standard mathematical operations such as matrix inversion and fast Fourier transforms.

The SMC toolkit is a list of acceptable Computer Aided Software Engineering (CASE) tools which will enable the scientist to develop and maintain his scientific software in a structured, standardized, yet flexible environment. These tools will include the full range of software development and maintenance tools covering all phases of the software development life cycle.

The IMS toolkits will provide data visualization tools, local SCF information management capabilities, and the capability to execute IMS services in a client-server mode. The IMS toolkits will be installed on both the IMS server computers and on the local workstations at the scientist's home facility.

The IMS toolkits will provide the capability to browse subsetted, subsampled and summary data products using the IMS server computer resources and local workstation resources. When IMS toolkits are installed at local workstations, the workstations will provide a local staging area for data products and will host the data visualization tools.

The IMS toolkits will also provide data base management capabilities at a local SCF to support the ingest and management of information on special products prior to their submission to the ECS. In providing these capabilities to the local sites, standards will be imposed that will facilitate the migration of special products into ECS.

7.5.2.1.10 Access to **Communications Services**

The IMS provides access to communication utilities for sending messages within the ECS and to non-EOSDIS and ADC networks, transferring data files throughout the system, and logging on to other processors in the network.

7.5.2.1.11 Statistics Collection for **Local System Management**

The LSM service monitors the usage of the IMS facilities locally and provides the SMC with information and statistical summaries on resource utilization and data usage information. This service employs an LSM toolkit which consists of a common set of management functions to interface with the SMC in support of an integrated system management capability for the entire ECS. The SMC provides the IMS with overall direction on resource utilization and resolves resource conflicts that are elevated to the SMC for adjudication.

7.5.2.2 IMS Architecture

Conceptually, the IMS architecture consists of IMS server computers located at each of the DAACs, workstations locally executing the IMS toolkit software, and SCFs executing the Virtual IMS information management software. Workstations, located remote from the IMS servers, at the scientist's home facility execute the IMS toolkit software to provide the user applications discussed above. The workstations are capable of executing the portable IMS toolkit software because of adherence to standards for window systems, graphics, and data base query languages.

A scientist's home computing facility with the Virtual IMS data base management software installed will have the capability to locally manage special product metadata prior to submission to EOSDIS. The Virtual IMS data base management system manages local data at the scientist's home facility.

7.5.2.2.1 IMS Interfaces

Figure ~~7.5.2.2.1-1~~ **7-5**, Conceptual IMS Context Diagram, illustrates the IMS interfaces to both EOSDIS and non-EOSDIS elements.

The IMS receives directives and user registration information from the SMC, and provides IMS status information and requests for user registration information to the SMC. The directives from SMC include cost estimation algorithms for ECS services, user account balance information, configuration management policy, fault management policy, security management policy, resource management policy, and schedule conflict resolution. The status provided to SMC includes configuration management data, schedule conflict alerts, IMS performance data, user assessment of ECS performance, fault data, security data, and resource management data.

The IMS sends product orders for archival data products, algorithms, EOC historical data, spacecraft housekeeping and ancillary data, and documentation to the DADS and receives product and documentation metadata, and product order status from the DADS. As data products are archived and metadata updates are inserted at the various ECS DADS, each DADS sends metadata updates for inclusion in the IMS directory and inventory of data sets.

The IMS will access the PGS product processing schedules for display to users, send user requests for product processing to the PGS, and receive product status from the PGS. Routine Standard Product processing, defined as product generation which is not user requested and which will occur each time the data inputs are available at the PGS, does not require continual intervention by the IMS. Once the processing thread for these products has been installed at the PGS, the IMS will send one initial "kick-off" processing order to the PGS, and the PGS will routinely schedule the production of these products.

To assist the user in completing a DAR, the IMS will receive spacecraft information and data acquisition schedules and plans from the EOC, and instrument information from the ICC. Once the user has completed the DAR submittal form, the IMS performs a high level reasonability check on the DAR and forwards the DAR to the ~~EOC~~ **ICC** for further evaluation and scheduling. As the DAR moves through the EOC scheduling process, the IMS receives DAR status updates from the EOC.

~~The IMS receives directives and user registration information from the SMC, and provides IMS status information and requests for user registration information to the SMC. The directives from SMC include cost estimation algorithms for ECS services, user account balance information,~~

(Note: MOVED -- Moved to the second paragraph of 7.5.2.2.1 where SMC interfaces are discussed)

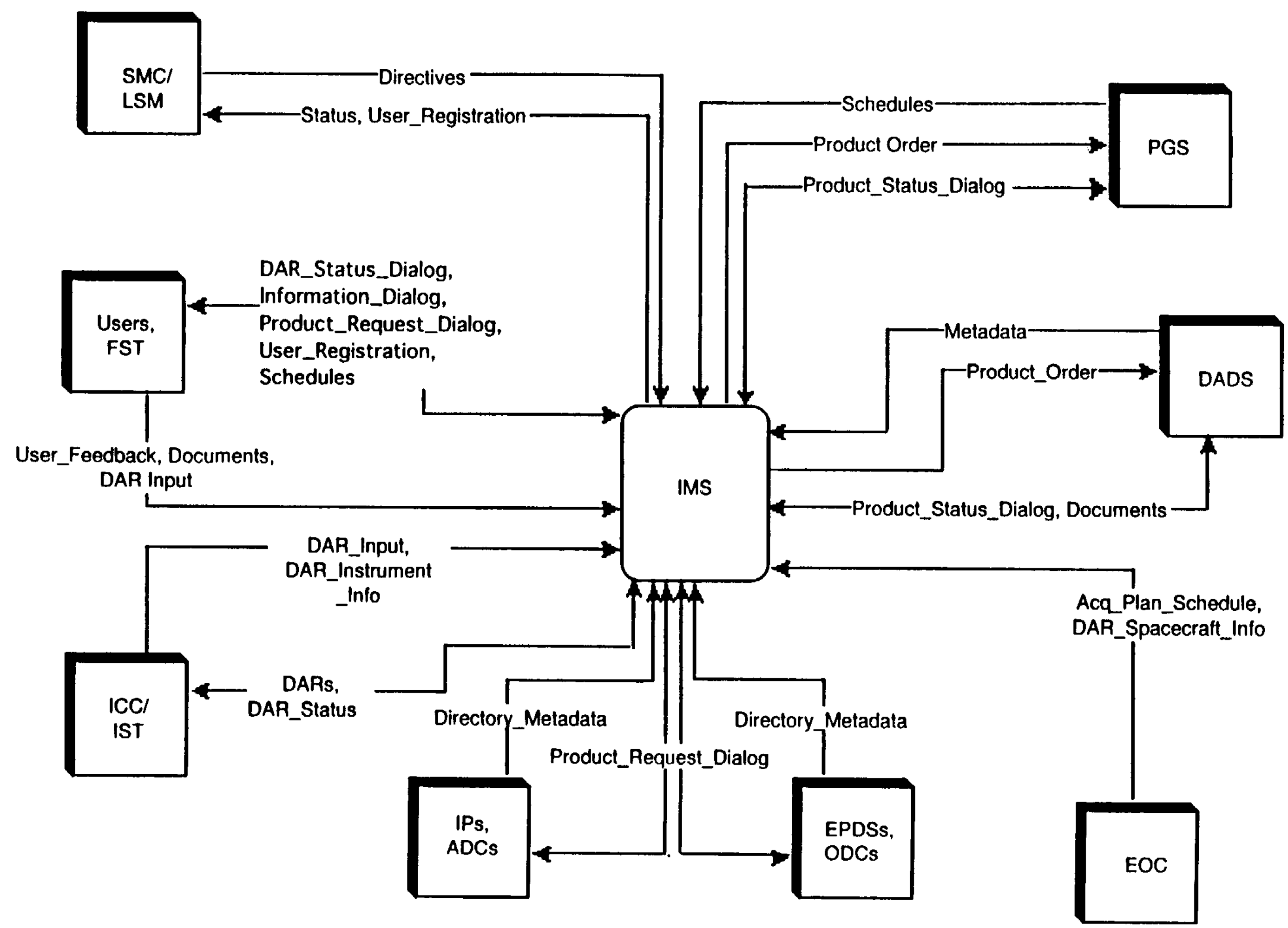


Figure 7-5. Conceptual IMS Context Diagram

As part of the Version 0 to ECS transition, the IMS will provide access to the Version 0 inventories and archival products through an interoperable interface to the Version 0 DAACs beginning at ECS Release 1.0, and continuing through ECS Release 2.0. After ECS Release 2.0, inventories and archival products from Version 0, that have not been migrated into the ECS, will be accessed from the IMS via a mutually agreed upon interface to the Version 0 DAACs.

7.5.2.2.2 Conceptual IMS Data Flows

Table ~~7.5.2.2.2~~-1 **7-3** lists and describes the data flows between the IMS and other EOSDIS and non-EOSDIS elements.

Table 7-3. Conceptual IMS Data Flows (1 of 4)

From	To	Data Item	Description
EOC	IMS	Acquisition Plans and Schedules	Instrument observation schedules and plans needed for Data Acquisition Request (DAR) formulation.
EOC	IMS	DAR Spacecraft Info	Observation constraints and other information needed for DAR planning.
ICC	IMS	DAR Instrument Info	Instrument constraints and other information needed for DAR planning.
Users	IMS	DAR Input	Parameters and other information entered by users allowing formulation of a Data Acquisition Request.
IMS	ICC/IST	Data Acquisition Requests (DARs)	Orders formulated by users for observations to be performed by one or more instruments; may have associated requests for product processing.
Users IMS	IMS EOC	DAR Status Dialog	Request for status of DAR.
ICC IMS	IMS Users	DAR Status	When a requested observation will take place, or reasons why it will not take place.
SMC	IMS	Directives	Policy guidelines including configuration, fault, security and logistics management information, conflict adjudication, product thread information, user account registration information, and user account balance.
IPs, ADCs, ODCs	IMS	Directory Metadata	High-level information on whole data sets which is searched by the IMS to determine the holdings at these centers.

Table 7-3. Conceptual IMS Data Flows (2 of 4)

From	To	Data Item	Description
DADS IMS Users	IMS DADS IMS	Documentation	Information describing the characteristics of a data set, information about processing EOS data, the results of science data quality assessments of EOS data, and instrument specifications. Different types of documentation may be stored at the IMS and DADS. The IMS will provide the capability to search for documentation and order it using the guide to documentation/reference material
IMS Users, IPs, ADCs, ODCs	Users, IPs, ADCs, ODCs IMS	Information Dialog	Includes the users' requests to search the directory, inventory and guide to documentation/reference material, search and order the Science Processing Library software, obtain cost estimates for data products and account status, view available processing services, view DAR schedules, view PGS processing schedules, view spacecraft housekeeping and ancillary data parameters, view ESDIS policies and procedures, and obtain status of product orders.
DADS	IMS	Metadata	Information about data, including information about special and Standard Products, documentation, spacecraft housekeeping and ancillary data, and Standard Product software. As data products are archived at the various ECS DADS, each DADS will send metadata updates to the IMS, and the IMS will modify its directory, inventory and guide to documentation/reference material to reflect the current information.
Users IMS	IMS PGS	Metadata Problem Reports	Information about corrections needed to metadata. The PGS will generate the corrected metadata and forward it to the DADS.

Table 7-3. Conceptual IMS Data Flows (3 of 4)

From	To	Data Item	Description
IMS IMS	PGS DADS	Product Orders	Users' requests for the generation or distribution of products. Each product order includes a general time window for completion, and a request priority. Product orders submitted to the DADS include requests for distribution of Standard Products (full resolution, subsetted, subsampled or summarized), special data products, Standard Product software, EOC historical data, spacecraft housekeeping and ancillary data, documentation, and other data archived at a DADS. Product orders will include requests for subsetted, subsampled, or summary data products that have not been generated at the PGS during standard production processing; therefore; ad hoc processing is required.
Users, IPs, ADCs, ODCs	IMS	Product Request Dialog	Inventory searches and user requests for product processing and distribution of data.
IMS	Users, IPs, ADCs, ODCs	Product Request Dialog	Conflict alerts generated by the PGS or DADS and passed to the IMS in the Product Status Dialog when products cannot be produced within the desired time window.
IMS IMS	PGS DADS	Product Status Dialog	A request for the status of product processing or distribution.
PGS DADS	IMS IMS	Product Status Dialog	Current status of product processing or distribution. If anytime during the processing of an order, it becomes clear that the order will not be satisfied within the estimated time window, then the PGS or DADS will notify the IMS and the IMS will notify the requestor.
SMC	IMS	Cost Estimation Algorithms	Algorithms to estimate the cost of requested ECS services for product order, processing, and acquisition.

Table 7-3. Conceptual IMS Data Flows (4 of 4)

From	To	Data Item	Description
PGS	IMS	Schedules	Current sequence of tasks to be executed along with approximate execution times.
IMS	SMC	Status	Information concerning resource utilization, fault detection, security, maintenance, logistics, and user feedback on ECS. Status includes requests for SMC conflict adjudication when conflicts cannot be resolved between the IMS, requestors, the DADS and the PGS. Refer to the SMC element specification for a complete definition of status.
IMS Users	Users IMS	User Registration Information	User requests for ECS accounts, and information exchanged between the user and the IMS during log-on sessions.
IMS SMC	SMC IMS	User Registration Information	Information necessary to uniquely identify a user for authorization/ authentication.
ICC/IST	IMS	DAR Input	ICC/IST will use IMS to initiate DARs.
IMS	ICC/IST	DAR Status	IMS will provide access to status on all submitted DARs.

7.5.2.3 IMS Functional Requirements

7.5.2.3.1 System Access and User Registration

7.5.2.3.1.1 System Access

IMS-0005 The IMS shall interface with the following external elements per the requirements specified in the referenced Interface Requirements Documents:

a. ADCs, per the ECS to ADCs IRD
b. ESA, per the ECS to ESA IRD
c. ASTER Ground System, per the ECS to ASTER IRD
d. NASDA, per the ECS to NASDA IRD
e. TRMM, per the ECS to TRMM IRD
f. ODCs, per the ECS to ODCs IRD
g. Landsat-7, per the ECS to Landsat-7 IRD
h. Version 0, per the ECS to Version 0 IRD
i. SCFs, per the ECS to SCFs IRD

IMS-0010 The IMS shall be capable of providing 24 hour per day, 7 day per week access to the ECS services.

IMS-0020 The IMS shall always be accessible to users and an informational status message describing the current availability status of ECS services and the predicted time for resumption of services which are temporarily unavailable shall be provided.

IMS-0030 The IMS shall provide from each ECS access node, access to the full range of services spanning the whole of ECS, including data and services available from all DAACs without requiring that the user know the physical location of the data.

IMS-0040 The IMS shall verify user authorization by validation of inputs with information as supplied by the SMC.

IMS-0050 The IMS shall provide the capability for users to define and modify user profile information, to include at a minimum:

a. User electronic address
b. Data distribution media
c. Data distribution address
d. User expertise level
e. Default query parameters
f. Terminal characteristics
g. Technical specialty
~~h. Request history~~

7.5.2.3.1.2 User Registration

IMS-0060 The IMS shall, when creating ECS user accounts, request registration approval, user account priorities, and authorized user services from the SMC.

IMS-0070 The IMS shall provide **the** user ~~registration information to the user, for example,~~ initial logon procedures, priority information, and authorized services **as maintained in the SMC**.

IMS-0080 The IMS shall maintain a list of authorized ECS services for each user and shall update the list with information supplied by the SMC.

IMS-0085 The IMS shall provide ~~unregisterd~~ **unregistered** users access to ~~a limited set of~~ ECS services **as authorized by the SMC**.

7.5.2.3.1.3 Global IMS User Interface

IMS-0090 The IMS shall be accessible to users via~~, at a minimum~~ **the following ESN communication services:**

a. Direct connection
b. Dial up connection
c. Network link

IMS-0100 The IMS shall support, at a minimum:

a. Interactive sessions
b. Non-interactive remote sessions
c. Client-server interface
d. Simulated sessions for training purposes

IMS-0110 The IMS user interface shall support access from dumb terminals, both local and remote, as well as bitmap display workstations that do not support the IMS toolkit.

IMS-0120 The IMS shall provide, dependent upon the user's display device capabilities, a user-friendly interface with the following features at a minimum:

a. Multiple window display
b. Buttons and pull down menus

c. Valid lists for all variables
d. ~~Access to~~ **Provide** an information base of associations between variables (*e.g.*, between instruments and geophysical parameters)
e. Ability to restore a session after interruption
f. Context-sensitive help
g. Minimal and consistent use of non-standard keys
h. Random movement through fields
i. Capability to save and restore the contents of a menu or form
j. Standardized use of commands and terminology across screens
k. Self-explanatory, meaningful error messages
l. Automatic acronym expansion, which can be enabled and disabled interactively
m. Availability of a menu tree diagram
n.Command language

IMS-0130 The IMS shall verify that a user is authorized to access a particular IMS service before providing the service to the user.

IMS-0140 The IMS shall provide the capability for multiple simultaneous sessions – for example, the capability to transition back and forth smoothly between directory search, inventory search, and data visualization. ~~For example, when viewing a directory entry, the user shall have immediate access to the corresponding catalog and inventory information.~~

IMS-0150 The IMS shall supply a uniform user interface for access to the following at a minimum:
a. Heterogeneous data sets
b. Communications networks
c. Data bases that are geographically dispersed
d. Multi-disciplined directories and inventories

IMS-0160 The IMS shall provide levels of user interaction support to include at a minimum:
a. Expert ~~(e.g.~~**i.e.**, quick command driven direct information input)
b. Intermediate ~~(e.g.~~**i.e.**, some prompting and automatically supplied help)
c. Novice ~~(e.g.~~**i.e.**, extensive prompting and help facilities)

IMS-0170 The IMS user interface shall be designed so that restructuring of the IMS data bases shall not result in the need for changes to the IMS interface.

IMS-0180 The IMS shall extract relevant data from the user profile information and display as default values.

IMS-0190 The IMS shall provide the capability to save information selected in prior metadata searches for use in subsequent IMS service requests, either in the current session or in future sessions.

~~IMS-0200 The IMS shall record IMS services usage by each user (to include at a minimum user name, IMS service identification, date/time stamp, time expended, facilities used) for later reporting and determination of access patterns.~~

MOVED -- Moved to IMS-1665

7.5.2.3.2 Information Management

IMS-0210 The IMS shall allow data access privileges to be configurable by user and data type for:
a. Read
b. Write
c. Update
d. Delete
e. Any combination of the above

IMS-0220 The IMS shall store, maintain and provide data management services for ECS directory, inventory, and ~~catalog of~~ **guide to** documentation/reference material and other IMS data bases.

IMS-0230 The IMS shall restrict update of ECS directory, inventory, and ~~catalog of~~ **guide to** documentation/reference material and other IMS data bases to authorized users based on the user's access privileges.

IMS-0240 The IMS shall provide, at a minimum, data base administration utilities for:
a. Modifying the data base schema
b. Performance monitoring
c. Performance tuning
d. Administration of user access control
e. On-line incremental backup
f. On-line recovery
g. Export/import of data

IMS-0250 The IMS shall provide an interface for required maintenance of the IMS data bases, to include at a minimum:
a. Capability to restructure the data base
b. Capability to interrupt a maintenance session and restart the session without loss of information

IMS-0260 The IMS shall provide interactive and batch information management capabilities for authorized users to add, update, delete, and retrieve information from the IMS data bases.

IMS-0270 IMS shall maintain information on the science processing library holdings and provide the capability for users to search for and order science processing library software.

IMS-0280 The IMS shall maintain DAR generation information, for example, instrument information received from the ICC and spacecraft information received from the EOC, in a data base which will be accessible during the DAR planning and submittal process.

IMS-0290 IMS internal data base management queries shall be expressed in a standard query language.

IMS-0300 The IMS shall maintain a log of all information update activity.

7.5.2.3.2.1 Metadata Data Base Management

IMS-0320 Standard Product related metadata shall contain, at a minimum:
a. Keywords and glossary from investigators

b. Keywords, synonyms, and glossary for cross-product and cross-directory referencing
c. Identifiers for locating products in the DADS archive by granule
d. Documentation on algorithms, including version history, authors, written description of product, equations, and references
e. Documentation on instrument(s) and spacecraft(s) including history of housekeeping and ancillary parameters, discipline characterization, calibration parameters, key individuals, and references
f. Identifiers, algorithms, written descriptions, equations, authors, and references associated with static ~~and dynamic browsing of~~ **browse products and** subsetted, subsampled, and summary data **products**
g. Published papers, research results, "significant" results, and references by author and date
h. Key organizations and personnel for all product-related DAACs, ADCs, and ODCs
i. Granule-specific information as listed in Tables C-10 and C-11 in Appendix C

IMS-0330 The metadata maintained by the IMS shall provide a cross reference that relates science data to the following at a minimum:
a. Calibration data, navigation data, and instrument engineering data
b. Processing algorithms used for data generation at the PGS
c. Software used for data generation at the PGS
d. Parameters used for data generation at the PGS
e. Input data used for data generation at the PGS
f. Data recipients
g. The PGS at which the data was processed
h. QA and validation data, reports, and algorithms

IMS-0340 The metadata maintained by the IMS shall contain content-based summary information, including statistical summaries and granule features, for all ECS standard and special products.

IMS-0350 The IMS shall provide the capability for authorized personnel to add, delete, or modify ECS metadata entries, individually or in groups.

IMS-0355 The metadata shall be expandable to include additional attributes which are identified during the mission and deemed useful for data search.

IMS-0356 The IMS shall provide **a mechanism to create and update** directory entries on EOSDIS data sets ~~to the NASA,~~ **and forward directory entries in the appropriate format to the Global Change** Master Directory.

MOVED -- Moved from IMS-0370.

7.5.2.3.2.1.1 Directory Level Metadata

IMS-0360 The IMS shall maintain **or provide access to** an on-line Earth Science master directory of information, which may be geographically distributed, that describes whole data sets in the Earth science disciplines.

~~IMS-0370 The IMS shall provide directory entries on EOSDIS data sets to the NASA Master Directory.~~

MOVED -- Moved to IMS-0356.

IMS-0380 The IMS shall **provide the capability to** exchange directory data with IP data centers, ADCs, and selected ODCs.

IMS-0390 The IMS shall maintain **or provide access to** directory entries for ~~IP, ADC, and ODC~~ **all** data sets accessible through the IMS search and order service.

~~IMS-0400 The IMS shall provide directory entry and update tools for entering free text entries to the directory.~~

DELETED -- Subsumed by IMS-0356

7.5.2.3.2.1.2 ~~Catalog of~~ Guide to Documentation and Reference Material Metadata

IMS-0410 The IMS shall maintain an on-line ~~catalog of~~ **guide to** documentation and reference material that provides information about individual EOSDIS data sets.

IMS-0420 The IMS on-line ~~catalog of~~ **guide to** documentation and reference material shall contain ~~pointers~~ **references** to such information as:

a. Documentation of processing algorithms used for EOS and other Earth science data products generated by the ECS
b. Results of science data quality assessments of EOS data
c. Bibliography of published and unpublished literature (as available) derived from the project
d. Cross references between differing studies of the same data
e. Other documents relevant to quality assessment of EOS data
f. Product specifications
g. Instrument specifications
h. Summaries of data sets derived from observation logs
i. Format options available for the given data set
j. Subsetting, subsampling, and transformation options available for the given data set
k. Inventory search options available for the given data set

7.5.2.3.2.1.3 Inventory Level Metadata

IMS-0430 The IMS shall maintain an on-line inventory with information that individually describes each granule of EOSDIS data, where granule refers to the minimum traceable logical unit of data stored in the archives, as defined by the instrument science team.

7.5.2.3.2.1.4 Spacecraft Housekeeping and Ancillary Parameters

IMS-0440 The IMS shall maintain information that describes spacecraft housekeeping and ancillary data parameters stored in the archives.

7.5.2.3.2.1.5 IMS and DADS Metadata Interface

IMS-0450 The IMS shall accept and validate new and updated metadata for all ECS archive data which has been ingested at the DADS.

IMS-0455 The IMS shall accept and validate new metadata from the DADS reflecting changes as a result of:

a. Purges
b. Transfers
c. Unexpected loss
d. Restoration of data after recovery from loss

IMS-0460 The IMS shall provide the capability to accept metadata problem reports from users, **and** inform the PGS quality assurance staff of the problem~~, and receive updated metadata from the DADS~~.

7.5.2.3.2.2 Documentation Management

IMS-0480 The IMS shall ~~provide the capability to ingest documentation and forward it to the DADS~~ **allow the user to store documents in the ECS.**

IMS-0490 The IMS shall ~~provide the capability to ingest~~ **support the following** ~~documentation in a number~~ of digital text formats:

a. ASCII text

b. WORD

c. Interleaf

7.5.2.3.3 Information Search

IMS-0500 The IMS shall provide access to information to include at a minimum:

a. Metadata
b. Spacecraft housekeeping and ancillary data information
c. Engineering data
d. EOC historical data
e. Data acquisition plans and schedules
f. Processing schedules
g. Documentation
h. ESDIS Project Policies and Procedures obtained from SMC data base
i. Science Processing Library software
j. Documentation on data format and metadata standards

IMS-0530 The IMS shall provide document text search.

IMS-0540 The IMS shall display PGS system processing schedules to users.

IMS-0550 The IMS shall allow a user to locate and identify desired data without detailed knowledge of the ECS's:

a. Architecture
b. Data Base management system
c. Data Base structure
d. Query languages
e. Data formats

IMS-0560 The IMS shall decompose complex data base search requests into executable data base queries in a manner which is transparent to the user.

IMS-0570 The IMS shall provide an incremental search capability.

IMS-0580 The IMS shall provide geographic ~~and geophysical~~ **surface features** overlays to aid in the selection of spatial data and to enhance the display of metadata.

~~IMS-0590 The IMS shall~~ ~~**provide the capability to**~~ ~~distribute information:~~

~~a. On-line (i.e., over a network)~~

~~b. Off-line (hardcopy or offline data media such as CD-ROM)~~

DELETED -- satisfied by DADS2490 and DADS2582

IMS-0600 The IMS shall provide the capability to search the ~~Earth Science~~ **Global Change** Master Directory of information that describes whole EOSDIS, non-EOSDIS, and ADC earth science data sets.

IMS-0610 The IMS shall provide the capability to search the data inventory which describes each granule of EOSDIS data.

IMS-0620 The IMS shall provide access to inventories of ~~selected~~ ODCs and ADCs **defined in paragraph 4.3.4** via level II and level III catalog interoperability as specified in ICDs.

IMS-0625 The IMS shall provide access to the inventory metadata maintained at the Version 0 DAACs via level III catalog interoperability as specified in ICDs.

IMS-0630 The IMS shall provide the capability to select metadata for retrieval by:

a. Boolean operators
b. Relational operators
c. Attribute values
d. Search strings
e. Combinations thereof

IMS-0640 The IMS shall provide the capability to query geographic metadata by any of the following criteria at a minimum:

a. Geographic reference
b. Data element content (as specified in metadata)
c. Minimum bounding rectangle
d. Point and radius
e. Geographic name ~~(based on a standard data base, such as USGS Geographic Names Information System)~~
f. Any combination of the above

IMS-0650 The IMS shall query non-geographic metadata by any of the following criteria at a minimum:

a. Exact word match
b. Phrase match
c. Character set (string)
d. Wildcard construct (prefix, embedded, suffix)
e. Character range
f. Logical and Boolean operators
g. Min/max range search
h. Any combination of the above

IMS-0660 The IMS shall provide inventory metadata search based on any combination of the core inventory (Table C-10, Appendix C) metadata attributes and geophysical parameters at a minimum.

IMS-0665 The IMS shall provide informational messages to indicate that a query is being executed, and shall provide the capability for the user to ~~terminate a time-intensive query before all hits are found, or to~~ abort any time-intensive operations.

IMS-0670 The IMS shall provide the capability to accept, validate, and fill orders from users for periodic delivery of information stored at the IMS.

7.5.2.3.4 Archival Product Requests

IMS-0680 The IMS shall provide data order capabilities integrated with metadata search capabilities.

7.5.2.3.4.1 EOSDIS Data Product Requests

IMS-0690 The IMS shall provide the capability to visualize pre-order data products and metadata (e.g. coverage maps, summary data) to facilitate the data selection and ordering process.

IMS-0700 The IMS shall provide the capability for users to browse subsetted, subsampled, and summary data products, which have been processed at the PGS during the routine production processing and archived at the DADS, whenever associated inventory information is displayed.

IMS-0720 The IMS shall provide the capability to ~~browse~~ **request** ~~subsetted, subsampled, and summary~~ data products which are processed ad hoc in response to user requests for **subsetting, subsampling, or averaging within a granule based on defined criteria to include**:

a. ~~Temporal subsetting~~ **Geographical location (x, y, z - spatial with rectangular boundaries)**
b. ~~Spectral subsetting~~ **Spectral band**
c. ~~Spatial subsetting with rectangular boundaries~~ **Time**
d. ~~Pixel subsampling~~

IMS-0730 The IMS shall, **using information supplied by the DADS,** provide the user an estimate of how long it will take before subsetted, subsampled, and summary data products are ready for visualization.

IMS-0740 The IMS shall provide the capability for users to generate and update requests for one-time orders or standing orders for the DADS to distribute DADS archive holdings to include, at a minimum, Standard Products, Standard Product software, EOC historical data, spacecraft housekeeping and ancillary data, and engineering data.

IMS-0750 The IMS shall provide the capability for the user to order Standard Product software and associated documentation in accordance with EOSDIS distribution criteria.

IMS-0760 The IMS shall access distribution criteria for each data product and data product software and compare the distribution criteria to the requestor's data access rights to verify that the data and software can be distributed as requested.

IMS-0770 The IMS shall allow users to formulate a data order.based on any combination of the inventory core metadata attributes and geophysical parameters at a minimum.

IMS-0780 The IMS shall accept and validate from the ECS users, IPs, ADCs, and ODCs requests for ECS archival data products.

IMS-0790 The IMS shall determine the location of requested data products and submit the product order to the data center where the data are archived.

IMS-0800 The IMS shall determine the amount of data expected to be returned as the result of the product order and provide the information to the requestor.

IMS-0810 The IMS shall prepare, for output to the DADS, product orders to retrieve specified data from the archive and distribute it, which contains the following information at a minimum:

a. Requestor identification
b. Data type
c. Data set identifier
d. Data set subsetting instructions
e. Data formats
f. Distribution instructions, including media requirements
g. Request priority
h. Suggested earliest start time
i. Suggested latest completion time

IMS-0820 The IMS shall provide to the user product order status~~/distribution conflict~~ information from the DADS to confirm or reject an order, which contains the following information at a minimum:

a. Requestor identification
b. Request identification
c. ~~Start~~ **Request** status ~~-- acceptance or rejection~~
d. If rejection, then ~~adjusted time -- start time and completion time~~ **the reason for the rejection**

IMS-0830 The IMS shall, using information provided by the DADS, notify users when products will not be distributed within the estimated time, and provide the reason for the delay and modified arrival times.

IMS-0840 The IMS shall provide the capability to receive data order status from the DADS when the ordered data has been shipped to the user.

~~IMS-0850 The IMS shall provide to the SMC data orders for the purposes of maintaining a full and complete history of all data orders.~~

MOVED -- Moved to IMS-1646

7.5.2.3.4.2 Requests for ADC and ODC Data

IMS-0860 The IMS shall provide an interface to ADC and ODC data systems and archives that produce, process, and/or maintain Earth science data sets and that have agreed to make the information and services available to ECS.

IMS-0870 The IMS shall provide access in accordance with MOUs to ADC and ODC data that

a. Has been generated by ADC and ODC data systems
b. Is stored by ADC and ODC archives and requested by EOSDIS users
c. Is required as ancillary data for production processing

IMS-0880 The IMS shall provide an interface to the ADC and ODC archives for ordering data to be delivered directly to the user or to a DADS.

IMS-0890 The IMS shall provide the capability to receive the metadata from the DADS when ADC or ODC data has been ingested into the ECS archives.

7.5.2.3.4.3 Requests for IP Data

IMS-0900 The IMS shall provide an interface to the IPs for ordering data to be delivered directly to the user or to a DADS.

IMS-0910 The IMS shall provide the capability to receive the metadata from the DADS, when IP data has been ingested into the EOSDIS archives.

7.5.2.3.4.4 Requests for Version 0 Data <<Added>>

IMS-0915 The IMS shall provide an interface to the Version 0 DAACs for ordering data products to be delivered directly to the user, or as specified in ICDs.

7.5.2.3.5 Data Processing Requests

IMS-0920 The IMS shall provide the capability for users to construct and submit standing orders and one-time requests for processing of ECS data by pre-existing processes, which shall contain the following information at a minimum:

a. Requestor identification
b. Algorithm input requirements
c. Text description of need for processing
d. Level 0-4 data set/subset
e. Required time of generation
f. Requested priority for product processing
g. Resulting product type
h. Distribution instructions (shipping information, media requirements)

IMS-0930 The IMS shall provide the capability to search metadata holdings for the purpose of identifying the product desired and the input data to be processed.

IMS-0940 ~~Searching~~ **The IMS shall integrate the searching** of metadata holdings for identifying information needed to complete a processing request ~~shall be integrated~~ into the request construction and submission process.

IMS-0950 The IMS shall accept from the originator changes to existing standing orders for data to be processed by the PGS.

IMS-0960 The IMS shall provide the capability to request priority processing of requested data.

IMS-0970 The IMS shall determine if requested data products already exist and can be retrieved.

IMS-0980 The IMS shall determine the necessary processing required to generate a requested product.

IMS-0990 The IMS shall determine if necessary lower level products exist ~~to enable~~ **for** processing of the requested data product.

IMS-1000 The IMS shall prepare, for output to the PGS, the processing product order for specifying processing and data to be used in generating a product, which shall contain the following information at a minimum:
a. Identification of the product(s) to be generated
b. Identification of the expected time/time window of receipt of input products, and ancillary data
c. Product processing priority
d. Destination(s) of product output
e. Suggested earliest start time
f. Suggested latest completion time

IMS-1010 The IMS shall accept from the PGS a processing status message to confirm or reject a processing order, which shall contain the following information at a minimum:
a. Requestor identification
b. Request identification
c. ~~Start~~ **Request** status ~~—acceptance or rejection~~
d. If rejection, then ~~adjusted time — start time and completion time~~ **the reason for the rejection**

IMS-1020 The IMS shall prepare, for output to the SMC, a request for conflict adjudication in the event a processing conflict cannot be resolved between the IMS, the requestor, and the PGS.

IMS-1030 The IMS shall accept from the SMC and provide to the requestor, conflict resolution, which shall contain the following information at a minimum:
a. Request identification
b. Data type
c. Priority modifications
d. Account balance modifications
e. Information on when request will be serviced
f. SMC contact point

IMS-1040 The IMS shall, using information provided by the PGS, notify users when processing will not be completed within the estimated time, and provide the reason for the delay and modified arrival times.

IMS-1050 The IMS shall provide the capability to notify the user community ~~if~~ **via the ECS bulletin board that** data has been reprocessed.

IMS-1060 The IMS shall maintain a cross reference of processing performed, data sets produced, supporting data used, and data recipient.

7.5.2.3.6 Data Acquisition Planning and Request Submittal

IMS-1070 The IMS shall provide the capability for users to construct DARs, for collection of EOS data, and Standard Product processing orders which are dependent upon the data acquisitions, which shall contain the following information at a minimum:
a. Data Acquisition Request:
    1. Observation number
    2. Experimenter identification
    3. Experimenter address
    4. Investigation identification

5. Scientific discipline
6. Observation repetition period
7. Tolerance in observation time
8. User priority
9. Scheduling priority and target of opportunity flag
10. Descriptive text
11. Location data expressed in terms of longitude and latitude as earliest start coordinates and latest stop coordinates
12. Earliest start time
13. Latest stop time
14. Minimum coverage required
15. Maximum coverage desired
16. Number of instruments involved in the investigation
17. Which instruments are involved in the investigation

b. Product Processing Order:
1. Products to be produced
2. Algorithm input requirements
3. Text description of need for processing
4. Distribution instructions (shipping information, media requirements)
5. Priority for product processing
6. Requested delivery time for product

IMS-1080 The IMS shall accept requests for acquisition of data to be processed one time or as standing orders.

IMS-1090 The IMS shall accept requests for changes to existing DARs from the requestor and forward the changes to the ~~EOC~~ **ICC**.

IMS-1100 The IMS shall accept from the EOC the current data acquisition schedules and plans and make the data acquisition schedules and plans accessible to authorized users on request.

IMS-1110 The IMS shall provide the capability to receive a product request from the user and determine the instrument(s) required for the data acquisition.

IMS-1120 IMS shall provide the capability to receive a geophysical parameter specification from the user and determine the instrument(s) required for the data acquisition.

IMS-1130 The IMS shall provide descriptive information on instruments and parameters available in Standard Products to help with the creation of data acquisition requests.

IMS-1140 The IMS shall provide instrument specific graphic displays to help with the creation of data acquisition requests, which shall include at a minimum:

a. Geographic reference aids
b. Spacecraft location projections

IMS-1150 The IMS shall provide product specific help to identify instruments needed to create a product.

IMS-1160 The IMS shall provide instrument specific default settings for instrument configurable parameters.

IMS-1170 The IMS shall provide instrument specific help to assist with setting instrument parameters.

IMS-1180 The IMS shall validate that user specified instrument settings are within the range of acceptable values.

IMS-1190 The IMS shall ~~perform a general feasibility check to verify that the data acquisition request does not violate EOSDIS data acquisition guidelines.~~ **validate DAR parameters against EOC and ICC provided constraints.**

IMS-1200 The IMS shall forward DARs for specific observational sequences generated by an authorized user to the ~~EOC~~ **ICC**.

IMS-1210 The IMS shall forward the processing product orders associated with a DAR to the appropriate PGS.

IMS-1220 The IMS shall forward, to the appropriate DADS, product orders for distribution of the products generated as a result of the DAR.

IMS-1230 The IMS shall accept from the ~~EOC~~ **ICC** and provide to the requestor such information as data acquisition request confirmation or rejection, and notification of data acquisition request scheduling and completion, to include at a minimum:

a. Date and time
b. Instrument ID
c. Data acquisition request ID
d. ~~Start~~ **Request** status ~~—acceptance or rejection~~
e. Implementation schedule
f. ~~Reason for failure~~ **If rejection, then the reason for the rejection**

IMS-1240 The IMS shall be expandable to accept from the IP Information Management System or an equivalent IP facility the current data acquisition schedules and plans for U.S. instruments on foreign spacecraft, and shall make the schedules and plans accessible to authorized users on request, in accordance with applicable MOUs.

IMS-1250 The IMS shall be expandable to forward DARs for U.S. instruments on IP spacecraft to the IP Information Management System or an equivalent IP facility, in accordance with applicable MOUs.

IMS-1260 The IMS shall provide the capability to receive, from the IP Information Management System or an equivalent IP facility, data acquisition request status in accordance with applicable MOUs and provide the status to the data acquisition requestor.

7.5.2.3.6.1 ASTER Data Acquisition Planning and Request Submittal

IMS-1261 The IMS shall provide the capability to forward data acquisition requests to the ASTER GDS, in accordance with applicable MOUs.

IMS-1262 The IMS shall provide the capability to receive, from the ASTER GDS data acquisition request status in accordance with applicable MOUs and provide the status to the data acquisition requester.

7.5.2.3.6.2 Landsat-7 Data Acquisition Planning and Request Submittal

IMS-1265 **The IMS shall provide the capability to forward data acquisition requests to the Landsat DHF, in accordance with applicable MOUs.**

IMS-1266 **The IMS shall provide the capability to receive, from the Landsat DHF data acquisition request status in accordance with applicable MOUs and provide the status to the data acquisition requester.**

7.5.2.3.7 Data Request Routing and Tracking

IMS-1270 The IMS shall determine the ECS elements responsible for processing and distributing, and the input data required for processing using the product thread information provided by the SMC.

IMS-1280 The IMS shall send a product order, priority, and suggested start time and completion time to the ECS elements responsible for processing and distributing a product.

IMS-1290 The IMS shall send a product order to an ADC or an ODC with the identification of the destination DADS and suggested shipping deadline for data required for product processing.

IMS-1300 The IMS shall be capable of responding to user inquiries for status of user-initiated requests.

IMS-1310 The IMS shall provide the capability to accept, from product requestors, product distribution status requests, retrieve the request status, and display the status to the requestor for an ECS, ADC, or ODC data product.

IMS-1320 The IMS shall provide the capability to accept, from data acquisition requestors, data acquisition status requests, retrieve the request status, and display the status to the requestor.

IMS-1330 The IMS shall provide the capability to accept, from data processing requestors, data processing status requests, retrieve the request status, and display the status to the requestor.

7.5.2.3.8 Cost Estimation and Account Status Interface

IMS-1340 The IMS shall, **using information provided by the SMC,** provide the capability for users to preview ~~billing~~ **estimated resource unit** costs for EOSDIS data products prior to order submission.

IMS-1350 The IMS shall provide the capability for users to preview ~~billing~~ **resource unit** costs, which are based upon ~~mutually agreed upon~~ MOUs with the ADC and non-EOSDIS data centers, prior to ADC and non-EOSDIS data product order submission.

IMS-1360 The IMS shall provide the capability for users to request and receive the current status of their account balance.

IMS-1370 The IMS shall present account status reports prepared by the SMC to requestors.

7.5.2.3.9 Toolkit Services

7.5.2.3.9.1 Toolkit Integration

IMS-1380 The IMS shall provide the capability to integrate the element toolkits with a common user interface.

IMS-1385 The IMS toolkit software shall be able to display interrupt messages from the ICC and EOC in real time.

7.5.2.3.9.2 Virtual IMS Information Management

IMS-1400 The Virtual IMS Information Management software shall operate with a local data base using **an ECS supported** DBMS provided by the SCF ~~which conforms to a set of to be determined standards~~, thereby facilitating the process of importation of the local data base into the ECS.

IMS-1410 The Virtual IMS Information Management software shall provide metadata management services for local SCF metadata.

IMS-1420 The Virtual IMS Information Management software shall provide the capabilities to search the local SCF data base.

IMS-1430 The Virtual IMS Information Management software shall provide local interactive and batch data management capabilities to:

a. Add
b. Update
c. Delete
d. Retrieve

IMS-1440 The Virtual IMS Information Management software shall provide local SCF data base administration utilities for, at a minimum:

a. Modifying the data base schema
b. Performance monitoring
~~c. Performance tuning~~
d. Administration of user access control
e. Data base backup
f. Data base recovery

IMS-1450 The Virtual IMS Information Management tools shall provide the capability to modify the data base structure while adhering to established standards.

IMS-1460 The Virtual IMS Information Management software shall provide the capability to electronically load data base structures and their content.

IMS-1470 The Virtual IMS Information Management software data base management system shall provide, at a minimum, the capability to select data for retrieval by:

a. Boolean operators
b. Relational operators
c. Attribute values
d. Combinations thereof

IMS-1480 The Virtual IMS Information Management software shall allow a user to locate and identify desired data without having detailed knowledge of the system's:

a. Architecture

b. Data base management system
c. Data base structure
d. Query languages
e. Data formats

7.5.2.3.9.3 IMS Toolkit User Application Services

IMS-1490 The IMS toolkit software shall provide users, including those working from ICCs and ISTs, with the capability to locally construct the requests for IMS services, forward the requests to the IMS server, and obtain request results.

IMS-1500 The IMS toolkit software shall provide the tools to support ~~automated generation~~ **user preparation** of metadata, for example, directory, inventory, and ~~catalog of~~ **guide to** documentation and reference material entries.

IMS-1505 The IMS toolkit software shall provide the tools to simulate an on-line IMS session for training sessions.

7.5.2.3.9.4 Data Visualization

IMS-1510 The IMS data visualization toolkit capabilities shall be portable and execute on ~~user~~ **ECS supported** workstations and appropriate ECS facility computers.

IMS-1520 The IMS toolkit software shall provide data visualization tools to assist the investigators to perform the following functions, at a minimum:
a. QA/Validation of products generated by the PGS
b. Algorithm development
c. Calibration functions, parameter verification, and anomaly detection
d. View subsetted, subsampled, and summarized data prior to ordering

IMS-1530 The IMS data visualization toolkit shall provide the capability to visualize data in raster and vector formats and to visualize animated products.

IMS-1540 The IMS toolkit software shall provide the capability to generate, at a minimum:
a. Two-dimensional plots (x-y plots, scatter plots, profiles, histograms)
b. Three-dimensional plots
c. Contour plots
d. Three-dimensional surface diagrams

IMS-1550 The IMS toolkit data visualization tools shall provide capabilities for image manipulation **(pan, zoom, color, contrast).**

IMS-1570 The IMS toolkit software shall provide statistical analysis capabilities.

IMS-1590 The IMS toolkit data visualization tools shall provide capabilities for sizing and positioning the cursor by:
a. Earth coordinates
b. Image coordinates
c. Instrument scan-line coordinated

7.5.2.3.10 Application Programming Interfaces (APIs) <<Added>>

IMS-1595 The IMS shall be developed with configuration-controlled application programming interfaces (APIs) that will be capable of supporting development of the following extensions to the ECS IMS by the DAACs:

a. **Addition of metadata fields that are unique to the data maintained at a specific DAAC**
b. **Addition of documents for use as guide metadata for DAAC-specific data products**
c. **Development of DAAC-specific data acquistion request utilities**
d. **Support of data visualization utilities for DAAC-specific products**
e. **Support of DAAC-specific data analysis utilities**
f. **Development of DAAC-unique metadata searching services that will operate independent of the delivered ECS IMS services**
g. **Development of a local user interface that can bypass the delivered ECS user interface for accessing DAAC-unique metadata searching services.**

7.5.2.3.~~10~~11 Access to **Communications Services**

IMS-1600 The IMS shall provide access to the following **ESN** communication services at a minimum:

a. File transfer
b. ~~Multi-media~~ **Electronic** mail
c. Remote log-on
d. Electronic Bulletin Board
~~e. Access to other networks~~

7.5.2.3.~~11~~12 Statistics Collection for **Local System Management**

IMS-1620 The IMS element shall collect the management data used to support the following system management functions:

a. **Fault Management**
b. **Configuration Management**
c. **Accounting Management**
d. **Accountability Management**
e. **Performance Management**
f. **Security Management**
g. **Scheduling Management**

IMS-1630 The IMS shall provide the capability to receive from the SMC, ~~via the LSM,~~ directives to include at a minimum:

a. Directives for integration, testing, and simulation
b. Maintenance directives
c. Configuration management ~~tools~~ **directives**
d. Logistics management directives
e. Training management directives
f. Fault management directives
g. Security directives

IMS-1640 The IMS shall provide to the SMC, ~~via the LSM,~~ status to include at a minimum:

a. Integration, testing, and simulation status
b. Maintenance status
~~c. Configuration management status~~
~~d~~**c**. Logistics status
~~e~~**d**. Training information
~~f. Fault management information~~
~~g. Security information~~

~~h. User feedback~~

IMS-1645 The IMS shall accept from the users and output to the SMC, user feedback information, which shall contain the following at a minimum:

a. Product data quality assessment
b. Schedule performance assessment
c. Evaluation of quality of ECS service

IMS-1646 The IMS shall provide to the SMC **a record of** data orders for the purposes of maintaining a full and complete history of all data orders.

MOVED -- Moved from IMS-0850

7.5.2.3.~~11~~12.1 Monitor IMS Usage

IMS-1650 IMS operations data shall contain information on:

a. System utilization at the IMS
b. Outstanding data distribution requests
c. Outstanding processing requests
d. Outstanding data acquisition requests

IMS-1660 The IMS shall ~~maintain~~ **provide to the SMC** a full and complete history of all IMS resources used by science investigators including, at a minimum:

a. CPU utilization
b. Amount of user storage
c. Connect time
d. Session histories

IMS-1665 The IMS shall ~~record~~ provide to the SMC, IMS services usage by each user (to include at a minimum user name, IMS service identification, date/time stamp, time expended, facilities used) for later reporting and determination of access patterns.

MOVED -- Moved from IMS-0200

~~IMS-1670 The IMS shall store and maintain information on data access patterns.~~

DELETED -- redundant with IMS-1665

IMS-1680 The IMS status monitoring function shall provide the capability to distribute reports on a periodic basis to a predefined list of report recipients.

IMS-1690 The IMS status monitoring function shall provide the capability to disseminate reports on-line electronically and off-line on either paper or electronic media.

IMS-1700 The IMS shall provide the capability to generate reports on:

a. The backlog of data distribution requests
b. The backlog of processing requests
c. The backlog of data acquisition requests
d. Data quality assessment
e. Daily IMS operations summaries
~~f. IMS performance summaries~~

IMS-1710 The IMS shall provide the capability to produce reports that correlate science data to associated:

a. Calibration data

b. Navigation data
c. Instrument engineering data

IMS-1720 The IMS shall provide the capability to produce reports that relate data sets to:
a. Processing algorithms used for data generation at the PGS
b. Software used for data generation at the PGS
c. Parameters used for data generation at the PGS
d. Data recipients

IMS-1730 The IMS shall provide the capability to produce reports that trace the data product back to the source instrument.

IMS-1740 The IMS shall produce cross reference reports (by user and data set) of processing performed, data sets produced, supporting data used, and data recipient.

7.5.2.3.~~11~~12.2 Fault Detection

IMS-1760 The IMS shall ~~detect and isolate~~ **send detected** hardware faults **to the SMC, to include** ~~associated with,~~ at a minimum:
a. IMS processors
b. IMS network interfaces
c. Storage devices

7.5.2.4 IMS Performance

The inventory size is based on the number of data sets and granules and size of granules given in Appendix C. For the purposes of IMS performance estimation, ~~catalogs~~ **guides** should be sized as 5000 documents of 50 pages each (average). A directory of at least 10,000 data set entries and an average record size of 2500 bytes per entry should be used in performance estimation. The user accounting system will be sized to track information on 100,000 users, and in request status checking, it should be assumed that there are 2000 outstanding requests for data.

The usage load for determining system performance is estimated from the number of orders and queries placed at data centers today and adding in a percentage for growth. Given this, there will be an average of 400 IMS queries per hour (including user authorization checks, inventory, directory, and ~~catalog~~ **guide** queries, and request status queries). In addition, the IMS must support the browse, document search, and ordering activities. For performance criteria, a load of 100 concurrent IMS sessions distributed across the DAACs will be assumed. These concurrent sessions will be distributed across the 8 DAACs in proportion to the projected use and activity at the various DAAC sites. In testing performance, level of activity (i.e., number of IMS operations per hour) should be at least that described in Table ~~7.5.2.4-1~~. **7-4.** Note that the number of operations in any category will be distributed among the specific operations indicated. The response times in Table ~~7.5.2.4-1~~ **7-4.** are based on a user environment and network configuration such that a full screen refresh (24 lines x 80 columns) can be performed in 2 seconds.

Table 7-4. IMS User Load and Concurrent Session Characteristics

Session Category	Number of IMS Operations per Hour	Specific Operation	Response Time Requirement*	Response Time Design Goal**
Log-on and Authorization	100	Account confirmation and authorization	15 sec	6 sec
Directory Search	80	Search by single keyword attribute	10 sec	2 sec
		Search by multiple keyword and time or space range check	15 sec	7 sec
~~Catalog~~ **Guide** Search	40	Search for document by keyword	10 sec	5 sec
Inventory Search	120	Search one instrument by multiple keyword attribute w/ time or space range check (one DAAC)	10 sec	2 sec
		Search multiple instruments by multiple keyword attributed w/ time or space range check (one DAAC)	20 sec	7 sec
		Multiple DAAC inventory search by keyword attributes and time and/or space range check	60 sec	11 sec
Status Check (account or request)	60	Status of pending order or Data Acquisition Request	15 sec	10 sec
		Account status retrieval	15 sec	6 sec
Browse *(for data selection)*	50	Retrieve and begin to display **standard pre-computed** browse product	60 sec **(TBR)**	
Document Search	10	Search 1000 document pages by keyword	5 sec	4 sec
Ordering Services	25	Local DAAC order submission and confirmation	15 sec	12 sec
		Remote DAAC order submission and confirmation	40 sec	30 sec
		Order cost estimate	15 sec	12 sec

*(from initiation of query to ~~response~~ **start of display)**

(from initiation of query to ~~response~~ **start of display, exclusive of user environment and network delay)

IMS-1780 The IMS shall respond to each user session operation within the time period specified in Table 7.5.2.4-1 with the specified rate of IMS operations.

IMS-1785 The IMS performance specified in Table 7.5.2.4-1 shall be maintained during other IMS operational activities such as database updates from the DADS.

IMS-1790 The IMS shall provide, based upon the data model defined in Appendix C, sufficient storage for, at a minimum:

a. Directory metadata
b. ~~Catalog of~~ **Guide to** documentation and reference material metadata
c. Inventory metadata
d. System space, ~~LSM data,~~ and data base system overhead
e. Metadata staging area
~~f. Documentation~~
g. Spacecraft housekeeping and ancillary data metadata
h. Science processing library software **metadata**
~~i. Histograms~~
~~j. User workspace~~

IMS-1800 The IMS design and implementation shall have the flexibility to accommodate 100% expansion in processing and storage capacity without major changes to the IMS hardware and software design. This expansion capacity shall apply to the total at-launch requirement plus the yearly product growth requirement specified in Appendix C.

8. Communications and System Management Segment (CSMS)

8.1 Overview

The Communications and System Management Segment performs system-wide services, as well as provides essential services to each element of the ECS. Communications; networking; network management; and system-wide, site, and element resource and operations management are but some of the services performed by this segment and provided to the other segments.

8.2 CSMS Elements

The CSMS is composed of two elements. These are the EOSDIS Science Network (ESN) element and the System Management Center (SMC) element. Both of these elements interact with all other elements of ECS as well as interface with external systems, ADCs, and ODCs. Based on direction from the Earth Science Data and Information System (ESDIS) Project, the SMC performs the high level, system-wide management for all elements of the ECS. Each site and element of the ECS, through its Local System Management (LSM) component, schedules and performs its own operations and resource management functions subject to coordination from the SMC, which is responsible for ensuring cross-DAAC coordination of product generation, including required inter-DAAC data transfers.

The ESN element is unique in that it provides the system-wide network management of the ESN as well as interacts with other network management centers external to the ECS, in ensuring connectivity among ECS sites and elements and between ECS and the world (i.e., EPDSs, ADCs, ODCs, IPs, and science users).

8.2.1 System Management Center (SMC)

8.2.1.1 SMC Overview

The main mission of the SMC is to provide a center where a system-wide view of the ECS operations can be maintained. This center then can provide system-wide coordination of activities at individual sites and element locations by providing high level resource configuration directions and schedule adjustments. This coordination is primarily to ensure that the ground systems activities needed for the successful completion of the science mission are properly shared among elements and are carried out in an efficient manner. This center also provides a source for administrative, security and accounting management on a system-wide basis.

To accomplish effective coordination between the SMC and the other ECS elements, the SMC provides each **site/**element with LSM services. ~~Conceived as a suite of tools, the~~ **The** LSM is the local management and operations component running on each **site/**element's architecture. The LSM provides a) a means by which local management and operations personnel control and monitor their ground resources, b) a means by which site managers monitor each of their element's ground operations activities at their particular site, c) a means by which the SMC monitors the ground operations events of each site and element, and d) a means of communication between the SMC, sites, and elements for management and operations information including directives, status, and user information.

The interaction between the SMC and the ECS elements varies from element to element. A subset of the capabilities identified in this specification is applied to each element.

The SMC does not provide the FOS elements with directives that affect their real-time operations. The directives are only for non real-time functions such as science directives, test scheduling, and upgrade coordination. The FOS elements are autonomous for functions such as operations configuration and real time fault management. (Note: FOS still interfaces with the SMC as a managed resource.)

The SMC provides ECS elements with a set of ~~sustaining functions for~~ **tools to support** engineering maintenance, logistics, and upgrades.

The services described below are ~~those~~ performed by the SMC and its distributed LSM. Except for the directory **information** service, both perform these services.

Scheduling Service

The Scheduling Service provides high level ground event schedules for all elements of the ECS. **A ground event consists of actions associated with configuring element resources, fault recovery, security, maintenance and testing. It also includes simulations, logistics, training, accounting and accountability, and general requests for information.** Each element's LSM at each site coordinates the ground schedule with the SMC to resolve potential conflicts with the schedule. ~~Ground events to be scheduled include tests, simulations, upgrades,etc.~~

Moreover, the Scheduling Service provides the means by which the SMC coordinates inter-DAAC product generation dependencies to ensure that the product generation is accomplished in accordance with the overall mission requirements. This service provides the SMC the capability to receive product generation schedules from each of the DAACs, analyze these schedules for inter-DAAC dependencies including both product generation and product transfer, ~~modify these~~ **direct** schedules **changes** to meet product generation requirements, and monitor these schedules for compliance.

Configuration Management Service

The Configuration Management Service provides configuration management for all **approved hardware and software components of** elements of the ECS. It responds to each site's and element's mission performance through configuration analysis and the implementation of modifications as required. In addition, maintenance actions are managed within this service as are spares inventory, logistics, and training programs. Moreover, to aid scientists in the development and integration of their algorithms into the DAAC, the SMC, in coordination with the scientists, ~~shall~~ **will** establish a list of acceptable Computer Aided Software Engineering (CASE) tools. This list is called the SMC toolkit.

Performance Management Service

The Performance Management Service monitors and evaluates each ECS site's and element's performance and performance trends. It generates fault or degradation alerts and maintains performance criteria.

Fault Management Service

The Fault Management Service provides the capability to locate, isolate, and identify fault conditions, the capability to generate corrective actions, and the capability to request diagnosis testing be performed to assist in fault identification.

Security Management Service

The Security Management Service provides the security management for all elements of the ECS. Such security management capabilities include password management, operational security, access to privileges, operational security, physical security, and security compromise detection, mitigation, and resolution.

Accounting and Accountability Service

The Accounting and Accountability Service provides the capability to perform security, data, and user audit trails, maintain end-to-end data accountability, resource configuration, financial services, and resource utilization costs.

Directory **Information** Service

The Directory **Information** Service is responsible for establishing and maintaining user, facility, and system profiles.

Report Generation Service

The Report Generation Service provides the capability to output various operational and administrative reports.

8.2.1.2 Conceptual SMC Architecture

The SMC element supports system-wide management for the ECS as well as provides each DAAC site or ECS element with a coordinated and consistent set of tools, namely the LSM software at that particular site or element. Additionally, the SMC element provides the tools supporting the management and operations of computer hardware and systems software for all sites and elements.

8.2.1.2.1 Interfaces

The SMC interacts with both external systems and data centers, as well as internally with all other ECS elements and the ESDIS Project. The external entities with which the SMC interacts are EDOS, ADCs, ODCs, EPDSs and the IPs. These interfaces and the data flowing between them are shown in **Figure 8-1**, Conceptual SMC Context Diagram.

The SMC receives overall direction from the ESDIS Project policies, procedures, and directives. These are the main managerial and scientific directives for the operation of ECS.

The SMC sends the ESDIS Project the system status and performance data of the ECS. In addition, SMC sends the project proposals for enhancements and information about schedule conflicts.

SMC's interface with EDOS, ADCs, ODCs, EPDSs and IPs is strictly for the explanation and resolution of scheduling conflicts. These scheduling conflicts apply only to data processing and data delivery and not to conflicts in EOS instrument scheduling. These latter scheduling conflicts are managed by the EOC.

SMC's interface with all other ECS elements is via SMC's LSM within each element. Management and operational personnel at each element are able to access and receive managerial and operational directives from the SMC using the LSM software. Likewise, the SMC accesses and receives each element's management and operational status via that element's LSM.

Other element specific data maintained by the SMC is made available to each specific element via the LSM. Such data include registration data for identifying and authenticating users.

8.2.1.2.2 Data Flows

Data flows between the SMC and its external and internal interfaces are shown in **Figure 8-1**. Detailed information on each data flow item is given in the functional requirements section. A brief description of each is given below.

The SMC receives the policies, procedures and directives from the ESDIS Project. These serve as the major source of direction for the ECS. The policies, procedures and directives include the overall mission, science data collection, data processing and reprocessing, data retrieval and data delivery guidelines, scheduling conflict and emergency situation directives, user authorization, system upgrade and budgetary directives.

The SMC sends to the ESDIS Project proposals for enhancements, system status and performance reports, and information about schedule conflicts. The Project will either approve, review, or give guidance in these areas.

System status and performance data consist of summary and detailed reports on the system as a whole and on each site and element. These reports include an assessment of how well the system and each site or element is meeting the science objectives.

The proposals for enhancements contain recommendations and supporting information for the upgrade of the system's hardware or software.

The SMC sends information on schedule conflicts to the ESDIS Project for resolution. The type of schedule conflict indicated here is a data processing, retrieval, or delivery scheduling type of conflict, rather than an instrument commanding or data collection scheduling type of conflict. Included in the schedule conflict data are all pertinent information, such as a description of the conflicting processes, their impacts on other processes, all applicable requirements, elements and external systems involved, and other historical conflict statistics.

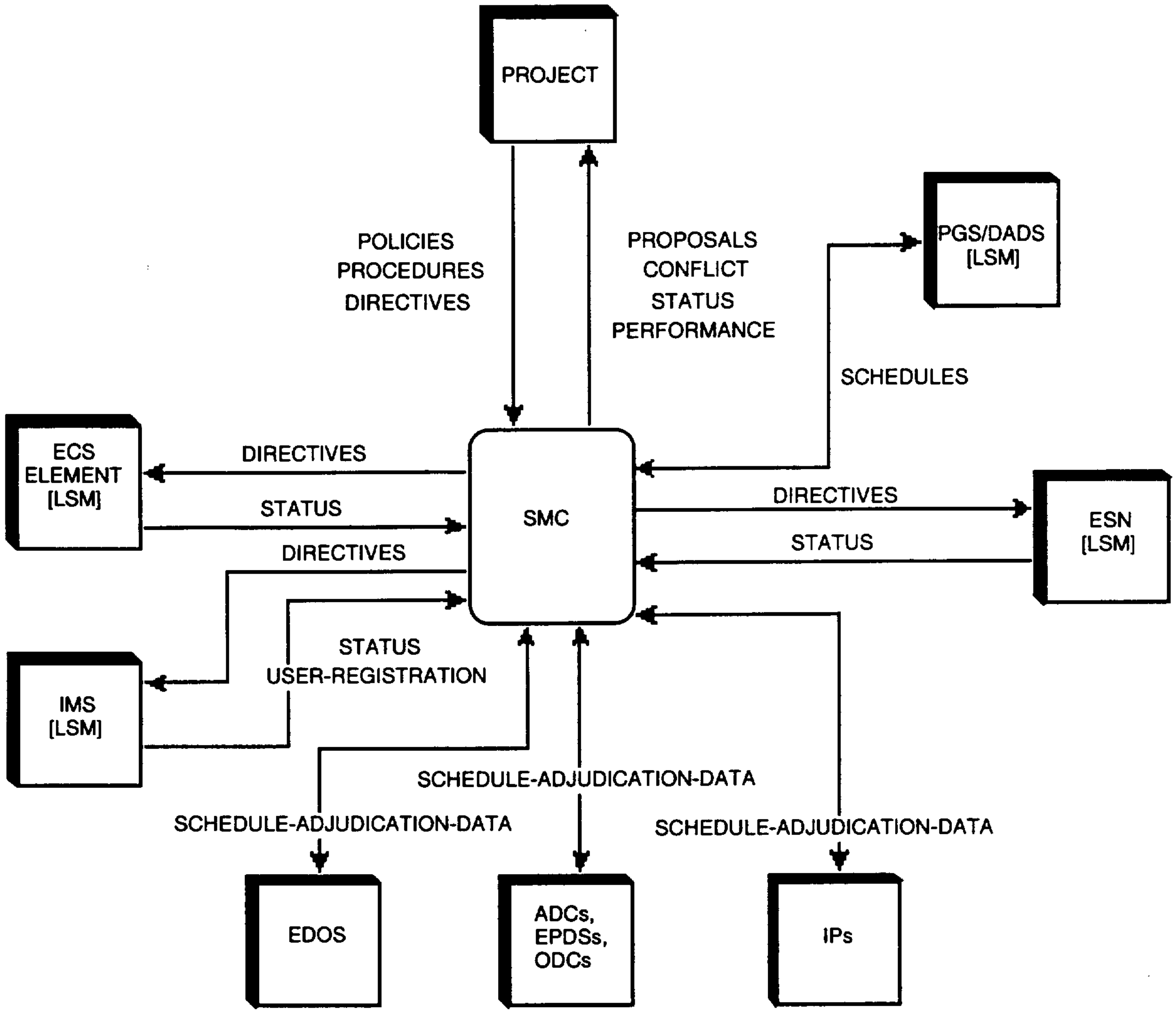


Figure 8-1. Conceptual SMC Context Diagram

The SMC sends directives to the ESN with status returned to the SMC. Directives and the returning status data cover the same categories of directives and status sent or received from the other elements, but are specific for the ESN network (e.g., traffic status, route usage, and route directives).

Schedule adjudication data sent between the SMC and external systems and elements (EDOS, ADCs, ODCs, EPDSs, and IPs) are similar to that just described for the ESDIS Project. Included in the schedule adjudication data is all pertinent information, such as a description of the conflicting processes, their effects on other processes, all applicable requirements, and elements or external systems involved.

Management and operations directives and operations status are accessed and received by each element from the SMC via the LSM at that element. Contained in these data are the scheduling, configuration management, performance management, fault management, security management, directory **information**, and accounting and accountability data.

Included in the scheduling data are those data necessary for SMC coordination of inter-DAAC product generation dependencies to ensure that the product generation is accomplished in accordance with the overall mission requirements. These data include each DAAC's product generation schedule, SMC ~~modified schedules~~, **schedule change directives** and product generation status used by the SMC to monitor schedule compliance.

User registration data are those items of information necessary to uniquely identify users and authorize use of the system.

8.2.1.3 SMC Functional Requirements

SMC-0005 The SMC shall interface with the following external elements per the requirements specified in the referenced Interface Requirements Documents:

a. ADCs, per the ECS to ADCs IRD
b. ESA, per the ECS to ESA IRD
c. ASTER Ground System, per the ECS to ASTER IRD
d. NASDA, per the ECS to NASDA IRD
e. TRMM, per the ECS to TRMM IRD
f. ODCs, per the ECS to ODCs IRD
g. Landsat-7, per the ECS to Landsat-7 IRD
h. Version 0, per the ECS to Version 0 IRD
i. SCFs, per the ECS to SCFs IRD
j. EDOS, per the ECS to EDOS IRD
k. NSI, per the External Networks Interface ICD

SMC-1000 The SMC shall provide application programming interfaces (APIs) for the monitoring and control of managed resources. These APIs shall provide mechanisms for:

a. Capturing, by an application, of management data.
b. Exchanging management data between a managed application and its management agent.
c. Exchanging management data between a management agent and the LSM.

d. **Performing analyses and generating reports using management data.**

8.2.1.3.1 Scheduling Service

8.2.1.3.1.1 Schedule Generation

SMC-1300 The SMC shall ~~support and~~ maintain the ECS policies and procedures regarding instrument and ground event scheduling, including, at a minimum:
- a. Mission and science guidelines
- b. Directives for scheduling instrument data ingest, processing, reprocessing, retrieval, and data distribution

SMC-1310 The SMC shall ~~support and~~ maintain the allocation of ground event functions and capabilities to each site and element.

SMC-1320 The SMC shall ~~support and~~ maintain priorities used in scheduling ground events.

SMC-1330 The SMC shall ~~support and~~ maintain ~~the~~ **end-to-end product processing** information for ~~end-to-end~~ data ingest, processing, reprocessing, archive, and data distribution for each **current** product, including, at a minimum:
- a. Product information
- b. Product generation information
- c. Product delivery information

SMC-1340 The SMC shall generate scheduling directives for system level, site-to-site, and element-to-element integration, testing, and simulation activities.

SMC-1350 The SMC shall generate scheduling directives for system level, site-to-site, and element-to-element maintenance activities.

SMC-1360 The SMC shall generate ground resource scheduling directives, ~~or~~ **and** recommendations for FOS elements, in response to emergency situations.

8.2.1.3.1.2 Schedule Adjudication

SMC-1500 The SMC shall perform schedule conflict analysis and **provide** resolution services in response to a schedule conflict involving sites, ECS elements, or external elements, agencies, or organizations, except for conflicts associated with flight operations.

8.2.1.3.1.3 Schedule Coordination

SMC-1600 The SMC shall receive product generation schedules from the DAACs and analyze the schedules for cross-DAAC dependencies (~~e.g.~~, **i.e.** inputs that must be generated and provided by one DAAC before a product can be generated at another DAAC).

SMC-1610 The SMC shall ~~make~~ **direct** adjustments in the product generation schedules to ensure that product generation functions and the DAAC-to-DAAC data transfers required, are accomplished in accordance with overall mission requirements ~~(e.g., without the development of a product generation backlog at any DAAC)~~.

SMC-1620 The SMC shall transmit ~~the adjusted~~ schedules **directives** back to the DAACs for implementation.

SMC-1630 The SMC shall monitor product generation and data transfers for compliance with the coordinated schedule.

8.2.1.3.2 Configuration Management Service

8.2.1.3.2.1 Resource Management

SMC-2100 The SMC shall have the capability to generate and send ground operations (i.e., non-instrument related) events to sites and elements for implementation. Ground operations events include, at a minimum, actions associated with:

a. Configuring element resources
b. Fault recovery
c. Security
d. Maintenance
e. Testing
f. Simulations
g. Logistics **spares and consumables**
h. Training **classes and scheduling information**
i. Accounting and accountability
j. General requests for information

SMC-2110 The SMC shall have the capability to generate managerial and operational directives affecting, at a minimum, an element's:

a. Operational status
b. Resource allocation
c. Upgrade

SMC-2120 The SMC shall make available for automated distribution to authorized users all **unlicensed** toolkit software, toolkit software upgrades, and toolkit documentation.

SMC-2130 The SMC shall administer and distribute licenses for deployed commercial-software funded by the ECS contract, including commercial software as authorized for specific users.

8.2.1.3.2.2 Maintenance Management

SMC-2200 The SMC shall assist each site or element, when necessary, in the performance of on-site preventive and corrective hardware and systems software maintenance.

SMC-2210 The SMC shall coordinate with each site or element in the management of off-site corrective hardware and systems software maintenance.

SMC-2220 The SMC shall monitor hardware and systems software maintenance status for off-site repair actions.

8.2.1.3.2.3 Logistics Management

SMC-2300 The SMC shall monitor the spares inventory within each element.

SMC-2310 The SMC shall oversee the replenishment of spare parts for all elements.

SMC-2320 The SMC shall monitor the consumable inventory within each element for items used by the system including, at a minimum:

a. Computer tapes
b. Computer disks
c. Computer paper

SMC-2330 The SMC shall monitor the replenishment of consumable items for all elements.

8.2.1.3.2.4 Training Management

SMC-2400 The SMC shall support the management of training and certification programs for ECS.

SMC-2410 The SMC shall provide support for the development of schedules for training courses.

SMC-2420 The SMC shall support the development of on-the-job training.

SMC-2430 The SMC shall support the development and use of training materials.

SMC-2450 The SMC shall support the evaluation of the effectiveness of the training programs.

8.2.1.3.2.5 Inventory Management

SMC-2500 The SMC shall establish and maintain a system-wide inventory of all hardware, scientific and system software~~, and the SMC toolkit~~ contained within ECS, including at a minimum:
a. Hardware or software identification numbers
b. Version numbers and dates
c. Manufacturer
d. Part number
e. Serial number
f. Name and locator information for software maintenance
g. Location where hardware or software is used

SMC-2510 The SMC shall provide at a minimum system-wide configuration management for ~~the operational~~ hardware, scientific, and system software~~, and the SMC toolkit~~ contained within ECS~~. The management system shall~~ **to** support the migration of hardware and software upgrades into the operational environment.

SMC-2520 The SMC **staff** shall evaluate received system enhancement requests to determine, at a minimum:
a. Technical feasibility
b. Implementation schedule
c. Expected costs
d. Existing system-wide hardware and software impacts

SMC-2530 ~~Upon approval of a system enhancement, the~~ **The** SMC shall provide overall management of the implementation of ~~the~~ **approved** changes to the hardware and system software.

SMC-2540 ~~Upon approval to include a fully tested enhancement to the algorithms, the~~ **The** SMC shall provide overall management of the implementation of ~~the~~ **approved and** modified **algorithm** software into the operational environment.

8.2.1.3.2.6 Policies and Procedures Management

SMC-2600 The SMC shall ~~support, control, and~~ maintain ECS policies and procedures covering the following areas, at a minimum:
a. Site or element responsibility and authority
b. Resource management
c. Fault recovery
d. Testing
e. Simulation
f. Maintenance
g. Logistics
h. Performance evaluation
i. Training
j. Quality and product assurance
k. Inventory management
l. System enhancements
m. Finance management
n. Administrative actions
o. Security

SMC-2610 The SMC shall provide ~~and maintain a bulletin board service with~~ information on ECS status, events, and news **via ESN's bulletin board service.**

SMC-2620 The SMC shall maintain via the ECS bulletin board service, the SMC toolkit consisting of a list of SDPS approved CASE tools for scientist use.

8.2.1.3.3 Performance Management Service

SMC-3300 The SMC shall monitor site and element hardware, and scientific and system software status to determine their operational states including, at a minimum:
a. On-line
b. Failed
c. In maintenance
d. In test mode
e. In simulation mode

SMC-3310 The SMC shall monitor each element's schedule and execution of events.

SMC-3320 The SMC shall monitor execution of ground operations events.

SMC-3330 The SMC shall ~~compare and~~ evaluate system-wide, site, and element actual schedule performance against planned schedule performance.

SMC-3340 The SMC shall perform quality assurance for the overall ECS performance as well as programmatic areas that include~~,~~ at a minimum:
a. System quality testing, **benchmarks,** and audits for system enhancement implementations
b. System quality checking and audits of products processed and delivered
c. Quality testing and audits of site and element resource performance.

SMC-3350 The SMC shall generate, maintain, and update performance criteria and responses to performance deficiencies for system, site, and element resources and activities, such as:
a. Data collection
b. Product generation, QA and validation

c. Reprocessing
d. Data delivery to DAACs and to users
e. Response to user requests
f. Response to TOOs
g. Response to field experiments
h. Response to emergency situations

SMC-3370 For each performance parameter, the SMC shall have the capability of establishing multiple levels of thresholds to include, at a minimum:
a. On/off
b. Pass/fail
c. Various levels of degradation

SMC-3380 The SMC **staff** shall evaluate overall system performance.

SMC-3390 The SMC shall generate alert indicators of fault or degraded conditions with the ~~appropriate~~ corrective actions.

SMC-3400 The SMC **staff** shall generate~~, as needed, requests~~ **directives** for performance testing that includes, at a minimum:
a. Resource to be tested
b. Test purpose
c. Requested test priority
d. Required test environment
e. Impacts to operations
f. Expected test results

SMC-3410 The SMC shall perform short and long-term trend analysis of system, site, and element performance to include, at a minimum:
a. Operational status
b. Performance of a particular resource
c. Maintenance activities (e.g., number of repairs per item)

SMC-3420 The SMC shall perform short and long term trend analysis of system, site, and element performance to determine the impact on resources of, at a minimum:
a. Modifying system, site, or element activity allocations
b. Potential enhancements to system, site, or element

SMC-3421 The SMC **staff** shall analyze user feedback information **from the IMS** supporting the development of recommended remedial or enhancement actions.

8.2.1.3.4 Fault Management Service

SMC-4300 The SMC shall ~~support~~, maintain, ~~and update~~ system fault management policies and procedures including, at a minimum:
a. Fault identification
b. Fault **recovery** priorities
c. Recovery or corrective actions

SMC-4310 The SMC shall perform fault analysis including, at a minimum:
a. Isolation
b. Location
c. Identification
d. Characterization

SMC-4311 The SMC shall have the capability to perform fault analysis to the level of, at a minimum:
a. Subsystem
b. Equipment

SMC-4320 SMC shall support fault diagnosis testing to include, at a minimum:
a. Software and hardware ~~tolerance~~ testing
b. ~~Resource-to-resource~~ Connectivity testing

SMC-4330 SMC shall have the capability to generate fault recovery commands, directives, and instructions to sites and elements except for faults directly related to flight operations.

8.2.1.3.5 Security Management Service

SMC-5300 The SMC shall, in conjunction with sites and elements, ~~establish, support,~~ maintain~~, and update~~ security policies and procedures to include, at a minimum:
a. Physical security
b. Password management
c. Operational security
d. Data security
e. Privileges
f. Network security
g. Compromise mitigation

SMC-5320 The SMC shall establish, maintain, and authenticate access privileges for ~~ECS scientific~~ **processes and** users.

~~SMC-5330 The SMC shall provide support, manage, maintain, and request security testing that includes, at a minimum, password checking and control of site and element internal privileges.~~

DELETED -- Subsumed by ESN-1360 and SMC-7300

SMC-5340 The SMC shall perform security risk analyses and compromise detection.

SMC-5350 The SMC shall have the capability to initiate recovery procedures in response to a detected security compromise.

SMC-5360 SMC shall have the capability to manage encrypted information, including keys.

8.2.1.3.6 Accounting and Accountability Service

SMC-6300 The SMC shall ~~support,~~ maintain ~~, and update~~ accounting and accountability policies and procedures based on ESDIS Project policies and procedures.

SMC-6301 The SMC accounting policies and procedures shall conform with accounting principles, standards, and facilities including:
a. General Accounting Office (GAO) Title 2-Accounting and Title 3-Audit
b. Office of Management and Budget (OMB) Circular No. A-127, Financial Management Systems
c. OMB Circular No. A-130, Management of Federal Information Resources

SMC-6310 The SMC shall ~~perform, as needed,~~ **produce** security audit trails.

SMC-6320 The SMC shall ~~perform, as needed,~~ **produce** data and user audit trails.

SMC-6330 The SMC shall ~~establish,~~ maintain ~~, and update~~ a data tracking system that, at a minimum:

a. Tracks data transport **and production** from system input to system output
b. Associates time with ~~each event in the transfer~~ **processing steps for audit purposes.**

SMC-6340 The SMC shall track system configuration that, at a minimum, audits:

a. Hardware resources
b. Software resources

SMC-6360 The SMC shall maintain **parameters** ~~the billing algorithms and rates~~ used to calculate resource ~~utilization~~ **unit** costs.

SMC-6370 The SMC shall make the ~~billing algorithms~~ **resource unit cost data** available to other elements for the purpose of informing science users of the **price** ~~cost~~ of ECS services.

SMC-6380 The SMC shall calculate the **average** resource unit costs associated with processing information from system input to system output.

SMC-6390 The SMC shall ~~establish,~~ maintain~~, and update~~ resource utilization account information for, at a minimum:

a. Individuals
b. Groups
c. Processes

SMC-6400 The SMC shall generate invoices, including billing information for ECS.

SMC-6410 The SMC shall perform on a periodic basis the generation and distribution of ~~bills~~ **CRU-denominated invoices.**

SMC-6420 The SMC shall perform the accounts payable, accounts receivable, and disposition of receipt accounting functions for ECS.

8.2.1.3.7 Directory Information Service

SMC-7300 The SMC shall ~~establish,~~ maintain~~, and update the~~ **an** authorized users inventory to include, at a minimum:

a. Users identifications
b. Addresses
c. Allowed privileges **(group or individual)**

SMC-7310 The SMC shall ~~establish,~~ maintain~~, and update~~ the approved facility and equipment inventory to include, at a minimum:

a. Facility and equipment identification
b. Addresses
c. Allowed accesses to privileges

SMC-7320 The SMC shall ~~establish,~~ maintain~~, and update~~ the system profile, as opposed to science data profile, inventory to include, at a minimum:

a. Data identifications
b. Data purposes
c. Data locations

d. Data classifications (**i.e.** proprietary, open, confidential~~, etc.~~) **as defined in NHB 2410.9, 9/90).**
e. Data priorities

8.2.1.3.8 Report Generation Service

SMC-8300 ~~Using any of the information accessible to or stored within the~~ **The** SMC, ~~the SMC~~ shall have a generalized report generator with the capability to customize output reports, covering, at a minimum, **data previously captured in a management DBMS including**:
a. All or portions of the system
b. Variable amounts of time

SMC-8400 The SMC shall retain management data for report generation purposes for a selectable period (up to 5 years), after which it is converted to a summary format.

SMC-8700 The SMC shall have the capability to generate a functional allocation report which gives the ~~current~~ allocation of ground segment functions to the sites and elements, including, at a minimum:
a. The allocation of generation and storage function by standard product to each ~~active archive~~ **DAAC**
b. The allocation of instrument responsibility to each ICC

SMC-8710 The SMC shall have the capability to generate summary and detailed configuration status reports that includes, at a minimum:
a. ~~Current status~~ **Status** of all hardware, and **system** ~~and~~ scientific, and **toolkit** software
b. ~~Reason why item not currently operational~~ **Free text maintenance information regarding failed items**

SMC-8730 The SMC shall have the capability to generate reports showing detailed and summary information about the maintenance schedule for system hardware, system software, and scientific software, including, at a minimum:
a. Routine maintenance schedules
b. Non-routine maintenance schedules
c. Upgrade maintenance schedule

SMC-8750 The SMC shall have the capability to generate detailed and summary training reports, including, at a minimum:
a. Training programs
b. Training course schedules **information**
c. Training course contents **synopsis**
d. Training course locations
e. Training attendees

SMC-8770 The SMC shall have the capability to generate, at a minimum, detailed and summary reports showing the inventory of:
a. Hardware, systems, ~~and~~ scientific and **ECS licensed toolkit** software
b. Spares and consumables

SMC-8790 The SMC shall have the capability to generate, as necessary, a list of proposed enhancements with at least these elements:
a. Proposal name

b. Description of enhancement
c. Rationale
d. **Anticipated** Impacts
e. **Estimated** Costs
f. **Estimated** Milestone schedule

SMC-8800 The SMC shall have the capability to generate detailed and summary reports indicating the overall performance of the ECS. At a minimum, they shall include:

a. Scheduled versus actual data collection, processing, retrieval, and delivery of routine data
b. Scheduled versus actual data collection, processing, retrieval, and delivery of user requested data
c. ~~Reason(s)~~ **Free text field** for failure to meet schedules
d. Quality of the data
e. Ground operations event execution
f. Number of interactive user requests and ~~timeliness of response~~ **service times**
g. User feedback

SMC-8820 The SMC shall have the capability to generate detailed and summary reports indicating the **product generation status** ~~progress~~ made in processing, reprocessing, and storage of all standard products and in processing quick-look data.

SMC-8840 The SMC **staff** shall have the capability to generate detailed and summary reports indicating the performance of ground resources, including, at a minimum:

a. Resource availability
b. Reason for down time
c. Resource utilization
d. Ability of resource to meet performance criteria
e. Short and long-term trend analysis and capacity planning results

SMC-8841 The SMC **staff** shall have the capability to generate detailed and summary user feedback analysis reports describing the results of analyzing user satisfaction queries, including, at a minimum:

a. User information
b. Type of transaction
c. Satisfaction statistics
d. User recommendations
e. SMC recommendations

SMC-8860 The SMC shall have the capability to generate detailed and summary fault management reports describing the fault management of ground resources, including, at a minimum:

a. Fault type and description
b. Time of occurrence of fault
c. **Free text field for** effect on system
d. **Free text field for** status of fault resolution
e. Fault statistics

SMC-8880 The SMC **staff** shall have the capability to generate detailed and summary security compromise reports indicating security compromises of ground resources and facilities, including, at a minimum:

a. Security compromise type and **free text** description
b. Time of occurrence
c. **Free text field describing** cause of security compromise
d. **Free text field describing** impact on system
e. **Free text field describing** status of security compromise resolution
f. Security compromise statistics
g. **Free text field describing** results of security compromise risk analysis

SMC-8890 The SMC **staff** shall have the capability to generate detailed and summary accountability reports describing the results of accounting audits of ground resources, security, work-in-process, data, and users of the system.

SMC-8920 The SMC shall have the capability to generate detailed and summary reports indicating the financial accounting of ground segment resource utilization by ECS and external users, including, at a minimum:
a. Account authorization and balances by users/groups
b. Resource utilization costs by service rendered
c. End-to-end cost accounting information by standard product
d. User/group accounts payable/accounts receivable information

8.2.1.3.9 Local System Management (LSM) Service

8.2.1.3.9.1 Scheduling Service

SMC-1305 The LSM shall ~~serve as a window through which the~~ **provide** SMC ~~can gain~~ access to ~~and receive~~ scheduling information from each element.

SMC-1315 The LSM shall ~~serve as a window through which~~ **provide** each element's scheduling function ~~has~~ **with** access to the system-wide scheduling information, including, at a minimum:
a. ECS policies and procedures regarding instrument and ground event scheduling
b. Other element's plans and schedules
c. Element allocations of ground event functions and capabilities
d. Product generation information
e. Scheduling directives for testing, maintenance, and emergency situations

~~SMC-1325 The LSM shall serve as the window through which operations and management staff at a site or element can communicate scheduling information to and receive scheduling information from the SMC, including, at a minimum:~~
~~a. Routine scheduling information~~
~~b. Request scheduling information~~
~~c. Schedule conflict alert information~~
~~d. Emergency scheduling information~~

DELETED -- Subsumed by SMC-1335

SMC-1335 The LSM shall have the capability to automatically **or interactively** ~~extract, process, and send to~~ **exchange with** the SMC, pertinent scheduling information **including the following:**
a. Routine scheduling information
b. Request scheduling information

c. **Schedule conflict alert information**
d. **Emergency scheduling information**

MOVED -- Partial move. Moved items (a) through (d) from SMC-1325.

SMC-1345 The LSM shall perform priority management services to resolve conflicts for ECS resources.

8.2.1.3.9.2 Configuration Management Service

8.2.1.3.9.2.1 Resource Management

SMC-2105 The LSM shall ~~convey~~ **respond to SMC and generate and send local** ground operations (i.e., non-instrument related) events to ~~sites or elements~~ **its site/element** for implementation. Ground operations events include, at a minimum, actions associated with:

a. Configuring element resources
b. Fault recovery
c. Security
d. Maintenance
e. Testing
f. Simulations
g. Logistics **(spares and consumables)**
h. Training classes **and scheduling information**
i. Accounting and accountability
j. General requests for information

SMC-2115 The LSM shall **respond to SMC and generate and send for local site/element** ~~convey for site or element~~ implementation, the managerial and operational directives regarding the allocation or upgrade of any element's hardware and scientific and systems software.

8.2.1.3.9.2.2 Maintenance Management

SMC-2205 The LSM shall support on-site preventive and corrective hardware and systems software maintenance.

SMC-2215 The LSM **staff** shall coordinate with the SMC in the management of off-site corrective hardware and systems software maintenance.

8.2.1.3.9.2.3 Logistics Management

SMC-2305 The LSM shall monitor the spares inventory within its element.

SMC-2315 The LSM shall manage the replenishment of spare parts within its element.

SMC-2325 The LSM shall monitor the consumable inventory within its element for items used by the system including, at a minimum:

a. Computer tapes
b. Computer disks
c. Computer paper

SMC-2335 The LSM shall manage the replenishment of consumable items for its element.

8.2.1.3.9.2.4 Training Management

SMC-2405 The LSM **staff** shall coordinate with the SMC in managing the training program for its element.

SMC-2415 The LSM shall receive from the SMC descriptions and schedules for training courses.

8.2.1.3.9.2.5 Inventory Management

SMC-2505 The LSM shall update the system-wide inventory data base consisting of all hardware, system software, and scientific software contained within its element.

SMC-2515 The LSM shall provide configuration management for ~~at least~~ the ~~operational~~ **site/element** hardware, system software, ~~and~~ scientific **and toolkit** software within its element and for the migration of enhancements into the operational system.

SMC-~~2525~~ **(2535)** ~~Upon approval of an enhancement,~~ The LSM shall facilitate the implementation of the **approved** changes within ~~an elements~~ **a site/element's** hardware and software.

8.2.1.3.9.2.6 Policies and Procedures Management

SMC-2605 The LSM~~, via LSM tools,~~ shall support the site/ ~~and~~ element in implementing ESDIS Project policies and procedures received from the SMC covering the following areas, at a minimum:

a. Element responsibility and authority
b. Resource management
c. Fault recovery
d. Testing
e. Simulation
f. Maintenance
g. Logistics
h. Performance evaluation
i. Training
j. Quality and product assurance
k. Inventory management
l. System enhancements
m. Finance management
n. Administrative actions
o. Security

8.2.1.3.9.3 Performance Management Service

SMC-3305 The LSM shall monitor its element's hardware, and scientific and system software status to determine their operational states including, at a minimum :

a. On-line
b. Failed
c. In maintenance
d . In test mode
e. In simulation mode

SMC-3315 The LSM shall monitor its **site/**element's schedule and execution of events.

SMC-3325 The LSM shall monitor execution of ground operations events.

SMC-3335 The LSM shall ~~compare and~~ evaluate its **site/**element's actual schedule performance against planned schedule performance.

SMC-3345 The LSM shall perform quality assurance for its site/element's performance as well as programmatic areas that includes, at a minimum:

a. Quality testing, **benchmarks** and audits for element enhancement implementations
b. Quality checking and audits of products processed and delivered
c. Quality testing and audits of **site/**element resource performance,

SMC-3355 The LSM shall **compare its site/elements performance against** ~~implement~~ the performance criteria from SMC (including parametric limits and operational threshold levels) for evaluating element resource performance.

SMC-~~3365~~ **(3375)** For each ~~limit checked~~ **performance** parameter, ~~the LSM~~ (including those thresholds directed by the SMC) **the LSM** shall have the capability of **establishing and** evaluating multiple levels of thresholds including, at a minimum:

a. On/off
b. Pass/fail
c. Various levels of degradation

SMC-~~3375~~ **(3385)** The LSM **staff** shall evaluate ~~system~~ **its site/element** performance against the Government established performance criteria **(TBD)**.

SMC-~~3385~~ **(3395)** The LSM shall generate, in response to each ~~limit check~~ threshold, alert indicators of fault or degraded conditions with the ~~appropriate~~ corrective actions.

SMC-~~3395~~ **(3397)** The LSM shall generate~~, as needed,~~ ~~requests~~ **directives** for performance testing, including, at a minimum:

a. Resource to be tested
b. Test purpose
c. Requested test priority
d. Required test environment
e. Impacts to operations
f. Expected test results

SMC-~~3405~~ **(3415)** The LSM shall perform short and long-term trend analysis of **site/**element performance, including, at a minimum:

a. Operational status
b. Performance of a particular resource
c. Maintenance activities (e.g., number of repairs per item)

8.2.1.3.9.4 Fault Management Service

SMC-4305 The LSM shall maintain ~~element~~ fault management policies and procedures for its **site/**element.

SMC-4315 The LSM shall, at a minimum, isolate, locate, and identify faults, ~~identify subsystem, equipment, and software faults,~~ and identify the nature of the faults within its **site/**element.

SMC-4325 The LSM shall request fault diagnosis testing be performed, including, at a minimum:

a. Software and hardware ~~tolerance~~ testing
b. ~~Resource-to-resource~~ connectivity testing within its element

SMC-4335 The LSM shall generate fault recovery commands, directives, and instructions (or recommendations in the case of-flight operations faults) within its **site/**element.

8.2.1.3.9.5 Security Management Service

SMC-5305 The LSM shall maintain security policies and procedures, including, at a minimum:

a. Physical security
b. Password management
c. Operational security
d. Data classifications
e. Access/privileges
f. Compromise mitigation

SMC-5325 The LSM shall promulgate, maintain, authenticate, and monitor user and **process** ~~device~~ accesses and privileges **within its site/element**.

~~SMC-5335 The LSM shall perform security testing that includes, at a minimum, password auditing and element internal access/privileges checking.~~

DELETED -- Subsumed by ESN-1360 and SMC-7300

SMC-5345 The LSM shall perform compromise ~~(e.g., virus or worm penetration)~~ risk analysis, ~~and~~ detection**, and mitigation, for its site/element.**

~~SMC-5355 The LSM shall isolate the compromised area, detach the compromised input I/O, and the compromised area's output I/O until the compromise has been eliminated~~.

DELETED -- Subsumed by SMC-5355 below

SMC-~~5365~~ **(5355)**The LSM shall generate recovery actions in response to the detection of compromises.

8.2.1.3.9.6 Accounting and Accountability Service

SMC-~~6305~~ **(6315)** The LSM shall ~~perform, as needed,~~ **produce** security audit trails within its **site/**element.

SMC-~~6315~~ **(6325)** The LSM shall ~~perform, as needed,~~ **produce** data and user audit trails within its **site/**element.

SMC-~~6325~~ **(6335)** The LSM shall, ~~as needed,~~ maintain ~~and update~~ a data tracking system that, at a minimum:

a. Tracks data transport **and production** from **site/**element input to ~~element~~ output

b. Associates time with ~~each event in the transfer~~ **processing steps for audit purposes.**

SMC-~~6335~~ **(6345)** The LSM shall, ~~as needed, perform~~ **track** configuration accountability to include, at a minimum, the ~~audit of~~ hardware and software resources within its **site/**element.

SMC-~~6355~~ **(6385)** The LSM shall~~, as needed,~~ calculate **average** the resource unit cost associated with processing information from **site/**element input to ~~element~~ output.

8.2.1.3.9.7 Report Generation Service

SMC-8305 The LSM shall have the same report generator capability as for the SMC, except it shall be limited to generating reports, covering only its particular site or its particular element.

SMC-8705 The LSM shall have the capability to generate the same types of reports listed under the SMC report generation service, except that each report shall cover only its particular site**/element and only for limited periods of time.** ~~or its particular element.~~

8.2.1.4 SMC Performance

SMC-0300 The SMC shall be designed to accommodate 100 percent growth in processing speed without requiring modifications or upgrades to existing applications software.

SMC-0310 The SMC shall be designed to accommodate 100 percent growth in storage capacity without requiring modifications or upgrades to existing applications software.

SMC-0320 The SMC shall be capable of scheduling ground activities to a minimum of one minute resolution.

SMC-0330 The SMC shall be capable of executing events to a minimum of one minute resolution.

SMC-0340 The SMC shall have the capability of responding to **detected** system faults within a maximum of five minutes.

SMC-0350 The SMC shall have the capability of responding to **detected** security compromises within a maximum of five minutes.

8.2.2 EOSDIS Science Network (ESN)

8.2.2.1 ESN Overview

ESN is responsible for exchange of data between the distributed ECS elements and connection to science network and other external facilities such as ADCs and selected SCFs. ESN also provides a set of application layer services and is responsible for management of communications including access.

~~Many existing networks already service EOS researchers and will continue to provide the required connectivity. The ESN must enable those researchers on existing networks to gain access to data and services of the ECS in a transparent manner to the underlying differences between the networks.~~

8.2.2.2 ESN Architecture

ESN, see **Figure 8-2**, will include an internal network for ECS communications, a network interface to the science user network (NSI **interface supports GOSIP, TCP/IP and Decnet Phase V only), a network interface to Ecom, a network interface to PSCN,** network services at the application layer, and a network management and help facility.

The internal network provides communications between ECS elements for element operations, DAAC-to-DAAC exchange of data products, IMS-to-IMS exchange to support user requests, collection of data products from IP pickup points, transfer and I&T of algorithms from selected SCFs (~~approximately 15-25~~ sites **TBD**), product QA from selected SCFs, flight operations interactions with the ISTs, and collection of data from ADCs and EPDSs. The ESN internal network consists of dedicated communications backbone circuits between the DAAC sites; tail circuits to ADCs, EPDSs, IP pickup points, and selected SCFs; and ECS LANs that support ECS elements. The internal network is not accessible by the general science user.

The ESN element provides an interface to the existing external science network (NSI) for user access to the IMS and electronic delivery of requested data products. Local (i.e., at DAAC site) users may be supported through site LANs directly to this interface. This interface also provides user access to ADCs and ODCs through the IMS interoperability capability. The ESN element provides an interface to Ecom for L0 data -production collection and distribution to the SDPS elements, and transfer of FOS data with flight assets via EDOS. Additionally, this inteface supports exchange of network management data with Ecom.

The ESN includes a set of standard **application** services compliant with GOSIP protocols.

A network management facility, located at GSFC, includes a support office and help desk for user assistance. The network management facility shall manage **intersite communication** ~~the internal operational network~~ and the network interface to the external network (NSI) and provide help to operational ECS personnel and to users when they are having difficulty accessing ECS services/systems.

ESN interfaces with the distributed ECS elements, the science user network (NSI), selected SCFs, ISTs, ADCs, IPs, and EPDSs. Element sections should be referenced for detailed descriptions of the data flows they require.

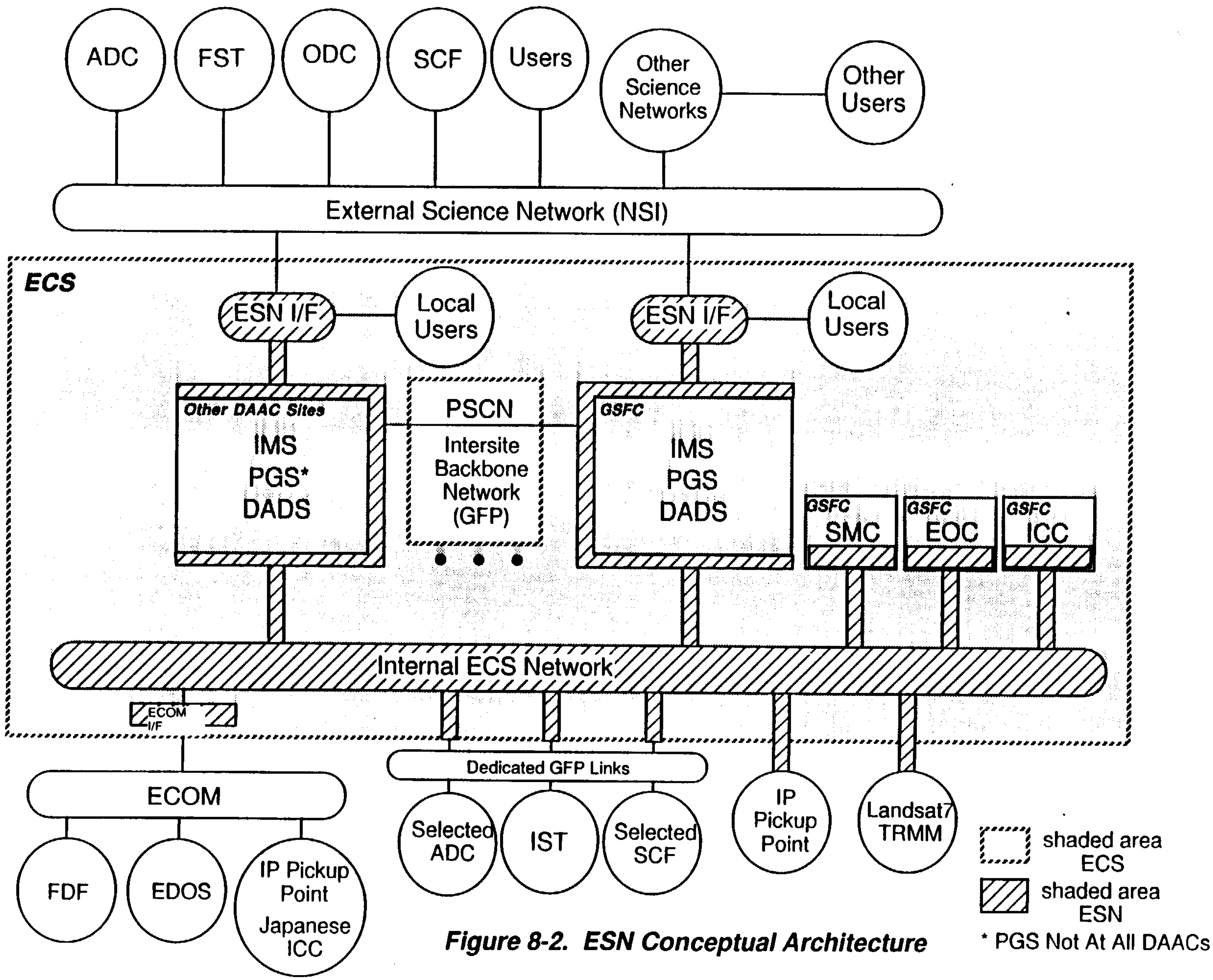


Figure 8-2. ESN Conceptual Architecture

The SMC interfaces with the ESN to receive network management status and reports.

In addition to inter-DAAC exchange of operational data, data types that are a part of the ESN data flow include ESN service requests, responses, network management, and network specific alarms and notifications.

8.2.2.3 ESN Functional Requirements

8.2.2.3.1 ESN General Communications

ESN-0002 **The ESN shall interface with the following external elements per the requirements specified in the referenced Interface Requirements Documents:**
- **a. NSI, per the ECS to External Networks IRD**
- **b. PSCN, per the ECS to PSCN IRD**
- **c. Ecom, per the ECS to Ecom IRD**

ESN-0005 The ESN internal networks shall **interconnect** ~~be dedicated networks linking~~ **resources within each** ECS ~~facilities~~ **facility** for internal ECS operations (e.g., scheduling, product generation, QA validation).

ESN-0006 ESN shall interface ~~to NSI for non-operational services with science users.~~ **with external networks for Inter-DAAC connectivity, connectivity to users, and connectivity to non-ECS EOSDIS systems to include:**
- **a. NSI for a non-operational communications services with science users**
- **b. PSCN for inter-DAAC communications services and direct connection of selected ADCs, EPDSs, and SCFs to ESN**
- **c. Ecom for operational communications services to support mission operations and data**

ESN-0007 The ESN shall **control** ~~prevent~~ access to the internal network from external non-ECS networks.

ESN-0010 ESN shall provide the following standard services:
- a. Data Transfer and Management Services
- b. Electronic Messaging Service
- c. **Remote Terminal Service** ~~Interactive Service~~
- d. Process to Process Communication Service
- e. Directory and User Access Control Service
- f. Network Management Service
- g. Network Security and Access Control Service
- h. Internetwork ~~gateway/hub~~ **Interface** Services
- **i. Bulletin Board Service**

ESN-0070 The ESN shall support the elements data flow requirements identified in this specification.

ESN-0080 The ESN shall provide internal communications interfaces to **GFP circuits which link to:**
- **a.** Specified **TBR** ADCs ~~for product generation.~~
- **b. Selected SCFs (TBR)**
- **c. Selected EPDSs (Landsat-7, TRMM)**
- **d. Selected ISTs (TBR)**

~~ESN-0090 The ESN shall support the internal ECS performance requirements identified in this specification.~~

DELETED -- Subsumed by ESN1206 and ESN1207

ESN-0180 The ESN shall ~~provide the internal communications interfaces to~~ **connect with** the International partners designated pickup points **at GSFC and JPL via GFP circuits.**

ESN-0210 The ESN management function shall have a capability to **obtain status on** ~~monitor~~ specific data flows, such as quick-look data products, to assure the successful operation of ESN. ~~and for trouble shooting problems.~~

ESN-0240 The ESN **shall be extensible in its design to provide capability for growth and enhancement.** ~~shall accommodate growth and changes over the life of the ECS, in terms of number of users, operational backbone network traffic, and ECS element traffic, while meeting the performance requirements.~~

ESN-0250 The ESN shall provide a help service to assist users with communication questions and problems.

8.2.2.3.2 Data Transfer and Management Service

The Data Transfer and Management Service provides the means to transfer and manage data transactions and ales over the ESN network.

ESN-0280 The ESN shall provide file transfer and management service ~~consistent with the OSI level 7 File Transfer, Access, and Management (FTAM) definition (ISO 8571)~~ and as a minimum shall include the capability to transfer the following **data** ~~document~~ types.

a. Unstructured Text
b. Binary Unstructured
c. Binary Sequential
d. Sequential Text

ESN-0290 The file transfer and management service shall be available in interactive and non-interactive services.

ESN-0300 The file transfer and management non-interactive services shall be able to be scheduled.

8.2.2.3.3 Electronic Messaging Service

The Electronic Messaging service provides ECS the ability to exchange information using a store and forward form of electronic mail.

~~ESN-0360 Message Oriented Text Interchange System (MOTIS) (DIS 10021) shall be supported as a minimum.~~

DELETED -- Subsumed by ESN-1330.

ESN-0340 The ESN shall interoperate and exchange messages and data with ~~other~~ **external SMTP and X.400** mail systems. ~~through GFE gateways including as a minimum: NASAmail, GSFCmail, the Internet, and Bitnet~~..

ESN-0350 The Electronic Messaging Service, ~~through MOTIS~~, shall be capable of exchanging binary data.

8.2.2.3.4 Remote Terminal Service

The ~~Interactive~~ **Remote Terminal** Service provides the ECS with a virtual terminal capability.

ESN-0370 The ESN shall provide interactive virtual terminal services. ~~conforming to the OSI "Basic Class Virtual Terminal Service" (OSI 9040) and the "Basic Class Virtual Terminal Protocol" (ISO 9041)~~.

8.2.2.3.5 Process-To-Process Communication Service

The Process-To-Process Communication Service provides transparent communication between application programs irrespective of their physical locations in the network. The inter-process communication service ~~shall~~ **will** provide a message exchange capability in a manner which is fully transparent to the distributed application programs.

ESN-0450 The ESN shall provide process-to-process communication service.

8.2.2.3.6 Network Directory and User Access Control Service

The directory service provides a system directory consisting of a collection of attributes (i.e., information) about, and relations between, a named set of addressable objects within a specific context (such as a research team).

ESN-0490 The ESN shall provide ~~an ISO~~ **a name-to-attribute mapping** Directory Service ~~(DIS 9594)~~ at a minimum.

ESN-0510 The directory function shall be able to respond to requests for information concerning named objects, either physical or logical, so as to support communications with those objects.

ESN-0590 The ESN Directory Service shall ~~include~~ **be protected by** access control capabilities.

ESN-0600 The ESN Directory service shall include ~~appropriate~~ services and supporting mechanisms to authenticate the credentials of a user for the purpose of granting access rights and authorizing requested operations.

ESN-0610 ~~Each~~**The** ESN ~~LAN~~ shall include **multiple** ~~one or more~~ Directory ~~System~~ **Service** Agents (DSAs) which shall be collectively responsible for holding **or retrieving** all directory information which is needed **by ECS.**

8.2.2.3.7 Network Management Service

The Network Management Service provides information about the ESN network system and a toolset to manage its resources.

ESN-0620 The ESN shall include a network management function to monitor and control the ESN.

ESN-0640 The ESN shall include ~~protocol layer~~ management functions at each ECS element, equipment or gateway ~~connected to~~ **within** the ESN.

ESN-0650 The ESN shall perform the following network management functions for each protocol ~~layer~~ **stack** implemented in ~~the~~ **any** ECS element, and each communications facility: ~~where appropriate for the protocol layer or communications facility:~~

a. Network Configuration Management
b. Network Fault Management
c. Network Performance Management
d. Network Security Management

ESN-0690 The ESN shall be capable of reconfiguration **with minimal** ~~without~~ disruption of network services.

ESN-0700 The ESN ~~network system~~ management architecture ~~used to manage ESN data communications facilities~~ shall be consistent with the architecture defined in the OSI Management Framework (ISO 7498-4) and the OSI Systems Management Overview (ISO DIS 10040).

ESN-0740 ~~A~~ **The ESN network management** service shall ~~be provided to~~ retrieve ~~information such as node status, traffic statistics, different types of faults, and device status information~~ **performance/fault data about ESN protocol stacks and equipment.**

ESN-0750 **The ESN shall provide** statistical processing capabilities ~~shall be integrated into the database system~~ to allow extraction and tabulation of **network performance** data. ~~to include, at a minimum such as a traffic histogram, error occurrences, and system performance statistics including such as number of packets received or transmitted, and packet size distribution.~~.

ESN-0760 ~~A~~ **The ESN** report generation function shall ~~be capable of providing~~ **provide** on **an interactive** ~~a demand~~ and scheduled basis, accounting, ~~system~~ **network** configuration, fault and performance management information.

ESN-0770 ~~A~~ **The ESN** query capability shall generate ad hoc statistics and reports based on parameters entered.

ESN-0775 The ESN management service shall have the capability to redirect its reports to different devices such as console, disk or printer.

MOVED -- from item d of ESN-0910

ESN-0780 The network elements including the Internet ~~gateways and hubs~~ **interfaces** shall have the capability to report, periodically and on **an interactive basis** ~~on-demand~~, network statistics to the ESN network management function, including ~~at least~~ the following information:

a. Network round trip delay
b. Network reset and restart indications
c. Outages and CRC errors
d. Performance statistics

8.2.2.3.7.1 Network Configuration Management

The Network Configuration Management service provides a set of capabilities to exercise control over the managed ESN objects, identify the managed ESN objects, and to provide data to managed ESN objects for the purpose of assisting in the continuous operation of ESN network. It will provide the capability to set network system parameters, initialize and close down managed ESN objects, track the current status and connectivity of managed ESN objects, and to change the ESN configuration.

ESN-0790 The ESN shall include the following configuration management functions at a minimum:

a. collect information describing the state of the network subsystem and its communications resources,
b. exercise control over the configuration, parameters, and resources of the subsystem, ~~(this may include control over the association of names with managed objects)~~ and over the information collected,
c. store the configuration information collected, and
d. display the configuration information.

ESN-0800 The ESN shall be capable of **displaying** ~~viewing~~ the local network configuration status related to each system locally, and for all systems at the ESN network management **facility** ~~center~~.

8.2.2.3.7.2 Network Fault Management

The Network Fault Management function will provide a set of capabilities to enable the detection, isolation, and correction of abnormal operations that may occur in ESN.

ESN-0810 ESN shall provide the following fault management functions at a minimum:

a. detect the occurrence of ~~a~~ faults,
b. control the collection of fault information, and
c. diagnose the probable cause of a **detected** fault.

ESN-0815 Network simulation and traffic modeling capability shall be provided to troubleshoot network problems and to use in network planning.

ESN-0830 **The ESN** ~~All network subsystems~~ shall have the capability to detect **and report** communications related errors and events. ~~locally, and report these errors and events. both locally and at the ESN network management facility.~~

ESN-0840 The ESN shall have error reporting, event logging and generation of alerts.

ESN-0900 Errors and events to be detected shall include at least:

a. communications software version or configuration errors
b. communications hardware errors
c. protocol errors
d. performance degradation conditions
e. telecommunications errors and failures
~~f. system level errors or failures~~

ESN-0910 The ESN fault management shall provide the capability to perform the following functions, at a minimum, both locally and at the ESN network management facility:

a. set, view, and change alert threshold values
b. enable and disable alert notifications (alarms) within a system
c. enable and disable event reports within a system
~~d. redirect reports to different devices, such as console, disk, or hard copy printer~~ .
e. manage error and event logging files

MOVED -- Moved item "d" to ESN-0775.

ESN-0920 The ESN shall provide a set of utilities to perform diagnostic and testing functions for purposes of fault isolation.

ESN-1000 The ESN network management function shall have the capability to build histories for different types of errors and events, and the capability to analyze errors and recommend corrective action wherever possible.

ESN-1010 The ESN shall provide, **for selective use as a debugging aid,** the capability to perform ~~protocol tracing or monitoring~~ **packet tracing of its supported protocols.**

ESN-1030 The ESN shall ~~provide for~~ **perform** periodic testing of ~~the backup~~ **alternate** communication ~~links~~ **capabilities** to verify that they are operational.

8.2.2.3.7.3 Network Performance Management

Network Performance Management provides a set of capabilities to evaluate the behavior of the managed ESN objects and the effectiveness of interconnection activities, gather statistical data, and maintain and examine logs of ~~system~~ **network** state histories.

ESN-1060 The ESN ~~network~~ performance management function shall provide the capability to evaluate the **performance** ~~behavior~~ of ESN ~~OSI~~ resources and ~~the effectiveness of~~ interconnection activities.

ESN-1065 The ESN performance management function shall include trend analysis for prediction of loading and bottlenecks/delays. ~~allowing reconfiguration to prevent disruption of service.~~

ESN-1070 The ESN shall provide the capability to perform the following functions, at a minimum:

a. generate/collect ~~system~~ **network** statistics
b. control collection/generation of network statistics
c. store ~~system~~ **network** statistics and statistical histories
d. display the ~~system~~ **network** statistics

ESN-1090 The ESN shall provide the capability to control the communications performance parameters of the network.

8.2.2.3.7.4 Network Security Management

The Network Security Management will provide the capability to detect and **control** ~~prevent~~ unauthorized access and abuse of the ESN networks.

ESN-1360 The ESN shall **control access of** ~~control access and only allow access by valid and authorized~~ **processes and** users **through an authentication and authorization service that meets GNMP standards.**

ESN-1365 The ESN shall ~~support access security to the EOC and ICC to insure that only authorized investigators have access to scheduling and operations~~ **isolate FOS from NSI with secure interfaces.**

ESN-1367 IST users not within FOS facilities shall communicate with secure interfaces only with the use of a data integrity service.

ESN-1380 **The ESN shall provide countermeasures for** the following security threats related to data communications:~~ shall be prevented by the required security services:~~

a. modification of data (i.e., manipulation) while in transit over the network
b. disclosure of ~~authentification~~ **authentication** information
c. degradation in network or **processing resource** ~~EOSDIS host/workstation~~ performance **through denial of service attack** ~~by repeated attempts to access the network or EOSDIS host/workstations~~
~~d. invalid access to devices~~
~~e. invalid access to data~~
~~f. invalid access to applications~~
d. Impersonation of authentication credentials or authorization privileges.

ESN-1400 The following security functions and services, at a minimum, shall be provided:

a. authentication
b. access **(authorization)** control
c. data integrity
d. data confidentiality

ESN-1430 **The ESN shall provide** the following security **event functions:** ~~mechanisms shall be provided:~~

a. Event detection**.** ~~and logging. data integrity violation and unauthorized network access attempts shall be detected and recorded in a security audit log; and~~
b. Event reporting. ~~detected security events shall be reported to the SMC.~~
c. Event logging.

~~ESN-0200 The ESN shall where practicable, monitor, detect and repair viruses, and also shall monitor for attempts to degrade performance.~~

DELETED -- Subsumed by SMC-5345

8.2.2.3.8 Internetwork Interface Service

The Internetwork **Interface** ~~Gateway~~ Services will provide basic services across all linked networks to enable the ECS elements and researchers to access resources.

ESN-1140 The ESN ~~gateway~~ ~~services~~ shall provide protocol translation, termination, bridging and routing~~, at a minimum~~.

ESN-1170 The **ESN** ~~gateway~~ ~~service~~ shall provide necessary translation ~~for application layer~~ **within supported file transfer and e-mail** services.

ESN-1180 The ESN shall interoperate with GFE NSI gateways to provide access to ECS via external user networks.

8.2.2.3.9 ESN Bulletin Board Service

ESN-1181 The ESN shall provide an ECS Bulletin Board capability based upon NNTP.

8.2.2.4 ESN Protocols and Standards

The ESN **is intended to** ~~shall~~ operate in a manner that is transparent to the user **and**~~—The ESN shall~~ be compliant with emerging ISO/OSI standards for GOSIP protocols and services.

ESN-1330 The ESN shall ~~provide~~ **support** ISO/OSI data communications protocols and services **as** specified in the ~~GOSIP~~ **GOSIP-2 to all external interfaces.** ~~(see **Figure 8.2.2.4-1**) for all communications.~~

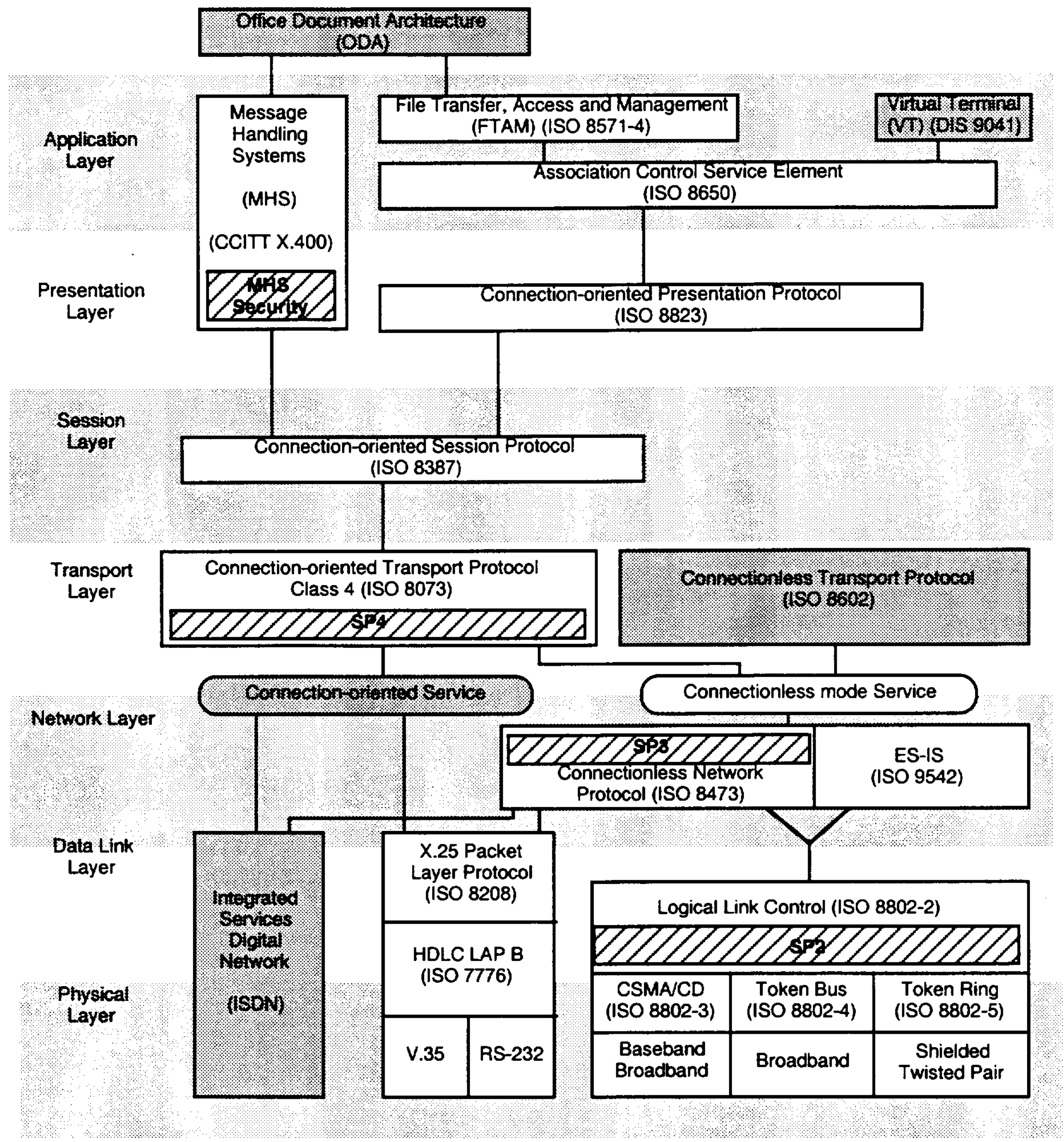
ESN-1340 The ESN shall provide support for TCP/IP communications protocols to all external interfaces.

ESN-1350 The ESN LANs shall provide physical devices and the corresponding medium access control (MAC) protocol compatible with ISO and ANSI standards.

8.2.2.5 ESN Capacity and Performance

ESN-1206 The ESN capacity and performance shall be consistent with the specified capacity and performance requirements of the ECS functions.

ESN-1207 The ESN capacity and performance shall be capable of expansion to be consistent with the specified capacity and performance growth requirements of the ECS elements and functions.



Scheduled for GOSIP Ver 3 (1990)
- Directory Services
- Optional TP2
- Computer Graphics Metafile
- VT (page & scroll profiles)
- 1988 MHS extensions
- FTAM extensions
- FDDI

= New in GOSIP Version 2

= Optional protocol or service

= Optional security protocol

Scheduled for Version 4 of GOSIP (1991)
- Transaction Processing
- Remote Database Access
- EDI

Figure 8-3. OSI GOSIP Protocol Architecture (Draft Version 2)

Appendix A. Glossary

Appendix A is a glossary of terms widely used in the EOS program.

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Affiliated Data Center (ADC)

A facility not funded by NASA that processes, archives, and distributes Earth science data useful for Global Change research, with which a working agreement has been negotiated by the EOS program. The agreement provides for the establishment of the degree of connectivity and interoperability between EOSDIS and the ADC needed to meet the specific data access requirements involved in a manner consistent and compatible with EOSDIS services. Such data-related services to be provided to EOSDIS by the ADC can vary considerably for each specific case.

Algorithm

Software delivered to the SDPS by a science investigator (PI, TL, or II) to be used as the primary tool in the generation of science products. The term includes executable code, source code, job control scripts, as well as documentation.

Ancillary Data

Data other than instrument data required to perform an instrument's data processing. They include orbit data, attitude data, time information, spacecraft engineering data, calibration data, data quality information, and data from other instruments.

Attitude Data

Data that represent spacecraft orientation and onboard pointing information. Attitude data includes:

- Attitude sensor data used to determine the pointing of the spacecraft axes, calibration and alignment data, Euler angles or quaternions, rates and biases, and associated parameters.
- Attitude generated onboard in quaternion or Euler angle form.
- Refined and routine production data related to the accuracy or knowledge of the attitude.

Averaging

Standard data averaging involves extraction from a data granule of aggregate pixels formed by numerically averaging the N adjacent pixels in each of one or more dimensions of the granule. The number of pixels in each dimension to be averaged is characterized by the value of "N."

Browse Data Product

Subsets of a larger data set, other than the directory and guide, generated for the purpose of allowing rapid interrogation (i.e., browse) of the larger data set by a potential user. For example, the browse product for an image data set with multiple spectral bands and moderate spatial resolution might be an image in two spectral channels, at a degraded spatial resolution. The form of browse data is generally unique for each type of data set and depends on the nature of the data and the criteria used for data selection within the relevant scientific disciplines.

Calibration Data

The collection of data required to perform calibration of the instrument science data, instrument engineering data, and the spacecraft engineering data. It includes pre-flight calibration measurements, in-flight calibrator measurements, calibration equation coefficients derived from calibration software routines, and ground truth data that are to be used in the data calibration processing routine.

Catalog Interoperability

Refers to the capability of the user interface software of one data set directory or catalog to interact with the user interface at another data set directory or catalog. Three levels of Catalog Interoperability are recognized:

Level 1 Interoperability – simple network interconnectivity among systems.

Level 2 Interoperability – catalog systems can exchange limited search and user information.

Level 3 Interoperability – catalog systems exchange standard search protocols. This provides "virtual" similarity between different systems.

Command and Data Handling (C&DH)

The spacecraft Command and Data Handling subsystem which conveys commands to the spacecraft and research instruments, collects and formats spacecraft and instrument data, generates time and frequency references for subsystems and instruments, and collects and distributes ancillary data.

Command Group

A logical set of one or more commands which are not stored onboard the spacecraft and instruments for delayed execution, but are executed immediately upon reaching their destination on board. For the U.S. spacecraft, from the perspective of the EOC, a preplanned command group is preprocessed by, and stored at, the EOC in preparation for later uplink. A real-time command group is unplanned in the sense that it is not preprocessed and stored by the EOC.

Commercial Off-The-Shelf (COTS)

"Commercial off-the-shelf" means a product, such as an item, material, software, component, subsystem, or system, sold or traded to the general public in the course of normal business operations at prices based on established catalog or market prices (see FAR 15.804-3(c) for explanation of terms).

Comprehensive and Incremental Scheduling

Two modes of scheduling. Comprehensive scheduling is the automatic scheduling of a full set of events. Incremental scheduling is interactive scheduling of selected events. For example, the initial generation of a schedule might use comprehensive scheduling, while the addition of a single event with the desire to avoid perturbing previously scheduled events might use incremental scheduling.

~~Conflict Free Schedule~~

Deleted, see "Detailed Activity Schedule."

Core-stored

Commands and tables which are stored in the memory of the central

Commands and Tables

onboard computer on the spacecraft. The execution of these commands or the result of loading these operational tables occurs sometime following their storage. The term "core-stored" applies only to the location where the items are stored on the spacecraft and instruments; core-stored commands or tables could be associated with the spacecraft or any of the instruments.

Correlative Data — Scientific data from other sources used in the interpretation or validation of instrument data products, e.g., ground truth data and/or data products of other instruments. These data are not utilized for processing instrument data.

Data Acquisition Request (DAR) — A request for future data acquisition by an instrument(s) that the user constructs and submits through the IMS.

Data Center — A facility storing, maintaining, and making available data sets for expected use in ongoing and/or future activities. Data centers provide selection and replication of data and needed documentation and, often, the generation of user tailored data products.

Data Product Levels — Data levels 1 through 4 as defined in the EOS Data Panel Report. Consistent with the CODMAC and ESADS definitions.

Raw Data – Data in their original packets, as received from the spacecraft and instruments, unprocessed by EDOS.

Level 0 – Raw instrument data at original resolution, time ordered, with duplicate packets removed.

Level 1A – Level 0 data, which may have been reformatted or transformed reversibly, located to a coordinate system, and packaged with needed ancillary and engineering data.

Level 1B – Radiometrically corrected and calibrated data in physical units at full instrument resolution as acquired.

Level 2 – Retrieved environmental variables (e.g., ocean wave height, soil moisture, ice concentration) at the same location and similar resolution as the Level 1 source data.

Level 3 – Data or retrieved environmental variables that have been spatially and/or temporally resampled (i.e., derived from Level 1 or Level 2 data products). Such resampling may include averaging and compositing.

Level 4 – Model output and/or variables derived from lower level data which are not directly measured by the instruments. For example, new variables based upon a time series of Level 2 or Level 3 data.

Data Set — A logically meaningful grouping or collection of similar or related data.

Data Set Documentation — Information describing the characteristics of a data set and its component granules, including format, source instrumentation, calibration, processing, algorithms, etc.

Detailed Activity Schedule — The schedule for a spacecraft and instruments which covers a 1 to 10 day period and is generated/updated daily based on the Instrument Activity Listing for each of the instruments on the respective spacecraft. For a spacecraft and instrument schedule the spacecraft subsystem activity specifications needed for routine spacecraft maintenance and/or for supporting instruments activities are incorporated in the Detailed Activity Schedule.

Direct Broadcast — Continuous down-link transmission of selected real-time data over a broad area (non-specific users).

Directive — **Flow down of policy.**

Directory — A collection of uniform descriptions that summarize the contents of a large number of data sets. It provides information suitable for making an initial determination of the existence and contents of each data set. Each directory entry contains brief data set information (e.g., type of data, data set name, time and location bounds).

Distributed Active Archive Center (DAAC) — An EOSDIS facility which generates, archives, and distributes EOS Standard Products and related information for the duration of the EOS mission. An EOSDIS DAAC is managed by an institution such as a NASA field center or a university, per agreement with NASA. Each DAAC contains functional elements for processing data (the PGS), for archiving and disseminating data (the DADS), and for user services and information management (elements of the IMS).

EDOS Production Data Sets — Data sets generated by EDOS using raw instrument or spacecraft packets with space-to-ground transmission artifacts removed, in time order, with duplicate data removed, and with quality/accounting (Q/A) metadata appended. Time span, number of packets, or number of orbits encompassed in a single data set are specified by the recipient of the data. These data sets are equivalent to level zero data formatted with Q/A metadata.

Spacecraft Engineering Data – The subset of engineering data from spacecraft sensor measurements and on-board computations.

For EOS, the data sets are composed of:

- instrument science packets,
- instrument engineering packets,
- spacecraft housekeeping packets, or
- onboard ancillary packets

with quality and accounting information from each individual packet and the data set itself and with essential formatting information for unambiguous identification and subsequent processing.

EDOS Quick Look Production Data Sets — Data sets generated by EDOS using raw instrument or spacecraft packets from a single TDRSS acquisition session and made available for delivery to a user within 1 hour of receipt of the last packet in the session. Transmission artifacts are removed, but time ordering and duplicate packet removal is limited to packets received during the TDRSS contact period.

Engineering Data — All data available on-board about health, safety, environment, or status of the spacecraft and instruments.

Instrument Engineering Data – All non-science data provided by the instrument.

Housekeeping Data – The subset of engineering data required for mission and science operations. These include health and safety, ephemeris, and other required environmental parameters.

Ephemeris Data	(See Orbit Data)
Facility Instrument	An instrument defined by NASA as having broad significance to the EOS Program and provided by a designated NASA center or foreign agency.
Granule	The smallest aggregation of data that is independently managed (i.e., described, inventoried, retrievable). Granules may be managed as logical granules and/or physical granules.
Ground Truth	Geophysical parameter data, measured or collected by other means than by the instrument itself, used as correlative or calibration data for that instrument data. It includes data taken on the ground or in the atmosphere. Ground truth data are another measurement of the phenomenon of interest; they are not necessarily more "true" or more accurate than the instrument data.
Housekeeping Data	(See Engineering Data)
Immediate Command	Command issued to an instrument or subsystem that is transmitted with minimum delay for immediate execution. Delay would be due only to non-availability of uplink and/or the actual time to transmit the command.
Incremental Scheduling	(See Comprehensive and Incremental Scheduling)
In Situ Data	(See Ground Truth)
Institutional Facilities or Elements	Facilities established by an institution that take on some responsibility in support of EOSDIS, or elements of the EOSDIS that function as part of an institution, and represent both EOSDIS and the programs, goals and purpose of the institution.
Instrument Data	Data specifically associated with the instrument, either because they were generated by the instrument or included in data packets identified with that instrument. These data consist of instrument science and engineering data, and possible ancillary data.
Instrument Engineering Data	(See Engineering Data)
Instrument Housekeeping Data	(See Engineering Data)
Instrument Micro-processor Memory Loads	Storage of data into the contents of the memory of an instrument's microprocessor, if applicable. These loads could include micro-processor-stored tables, microprocessor-stored commands, or updates to microprocessor software.
Instrument Science Data	Data produced by the science sensor(s) of an instrument, usually constituting the mission of that instrument.

Interdisciplinary Investigator Computing Facilities (IICF) — Project-provided facilities at interdisciplinary investigator locations used to pursue EOS-approved investigations and produce higher-level data sets.

Investigator Working Group (IWG) — A group made up of the Principal Investigators and research instrument Team Leaders associated with the instruments on a single spacecraft. The IWG defines the specific observing programs and data collection priorities for a single spacecraft based on the guidelines from the IIWG.

Long-Term Instrument Plan (LTIP) — The plan generated by the instrument representative to the spacecraft's IWG with instrument-specific information to complement the LTSP. It is generated or updated approximately every six months and covers a period of up to approximately 5 years.

Long-Term Science Plan (LTSP) — The plan generated by the spacecraft's IWG containing guidelines, policy, and priorities for its spacecraft and instruments. The LTSP is generated or updated approximately every six months and covers a period of up to approximately 5 years.

Metadata — Information about data sets which is provided to the ECS by the data supplier or the generating algorithm and which provides a description of the content, format, and utility of the data set. Metadata may be used to select data for a particular scientific investigation.

Off-Line — Access to information by mail, telephone, facsimile, or other non-direct interface.

On-Line — Access to information by direct interface to an information data base via electronic networking.

Operational Data — Data created by an operational instrument (i.e., NOAA AMRIR).

Orbit Data — Data that represent spacecraft locations. Orbit (or ephemeris) data include: Geodetic latitude, longitude and height above an adopted reference ellipsoid (or distance from the center of mass of the Earth); a corresponding statement about the accuracy of the position and the corresponding time of the position (including the time system); some accuracy requirements may be hundreds of meters while other may be a few centimeters.

Payload — Complement of instruments for a mission on a spacecraft or spacecraft.

Playback Data — Data that have been stored on-board the spacecraft for delayed transmission to the ground.

Preplanned Command Group — (See Command Group)

Preplanned (Stored) Command — A command issued to an instrument or subsystem to be executed at some later time. These commands will be collected and forwarded during an available uplink prior to execution.

Subsetting	**Standard subsetting involves extraction of a multi-dimensional rectangular array of pixels from a single data granule, where consecutive pixels are extracted from each array dimension. For each dimension, the size of the pixel array is characterized by the starting pixel location and the number of pixels to extract.**
Target of Opportunity (TOO)	A TOO is a science event or phenomenon that cannot be fully predicted in advance, thus requiring timely system response or high-priority processing.
Team Member Computing Facilities (TMCF)	Project-provided facilities at research instrument team member locations used to develop and test algorithms and assess data quality.

Appendix B. Acronyms

Appendix B is a list of acronyms and abbreviations used in the requirements specification or the ECS Statement of Work

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A/C	Air Conditioning
AC	Atmospheric Chemistry
ACE	Advanced Composition Explorer
ACRIM	Active Cavity Radiometer Irradiance Monitor
AD	Applicable Document
ADC	Affiliated Data Center
ADCLS	Advanced Data Collection and Location System
ADEOS	Advanced Earth Observing Satellite
ADP	Automated Data Processing
ADPE	Automated Data Processing Equipment
AI	Artificial Intelligence
AIR	Airborne Imaging Radar
AIRS	Atmospheric Infrared Sounder
AIS	Automated Information Security
ALPEX	Alpine Experiment
ALT	Altimeter
AMEX	Australian Monsoon Experiment
AMRIR	Advanced Medium Resolution Imaging Radiometer
AMSU	Advanced Microwave Sounding Unit
Andes MIS	Andean Morphstectonic Information System
ANSI	American National Standards Institute
AO	Announcement of Opportunity
Ao	Operational Availability
AOL	Airborne Oceanographic Lidar
ARPANET	Advanced Research Projects Agency Network
ASAS	Advanced Solid-State Array Spectrometer
ASCII	American Standard Code for Information Interchange
ASF	Alaska SAR Facility
ASTER	Advanced Spaceborne Thermal Emission and Reflection
AT	Acceptance Test
AVHRR	Advanced Very High-Resolution Radiometer

AVIRIS	Airborne Visible and Infrared Imaging Spectrometer
BDRFs	Bidirectional Reflectance Distribution Function
BER	Bit Error Rate
BIP	Background Information Package
BOD	Beneficial Occupancy Date
bps	Bits Per Second
C&T	Communications and Tracking
CAD	Computer Aided Design
CASE	Computer Aided Software Engineering
CCB	Configuration Control Board
CCRS	Canadian Centre for Remote Sensing
CCSDS	Consultative Committee for Space Data Systems
CDHF	Central Data Handling Facility
CDR	Critical Design Review
CDRD	Contract Data Requirements Document
CDRL	Contract Data Requirements List
CD-ROM	Compact Disk (Optical), Read-Only Memory
CERES	Clouds and the Earth's Radiant Energy System
CFS	Conflict-Free Schedule
CIESIN	Consortium for International Earth Science Information Network
CM	Configuration Management
CNES	Centre National D'Etudes Spatiales
CO	Contracting Officer
COARE	Coupled Ocean-Atmosphers Response Experiment
CODMAC	Committee on Data Management and Computation
COHMEX	Cooperative Huntsville Meteroroligical Experiment
COTR	Contracting Officer's Technical Representative
COTS	Commercial Off-The-Shelf
CPT	Contractor Provided Training
CPU	Central Processing Unit
CRC	Cyclic Redundancy Code

CRR	Capabilities and Requirements Review
CSA	Canadian Space Agency
CSIRO	Commonwealth Scientific and Industrial Research Organization
CSMS	Communications and System Management Segment
CSR	Consent to Ship Review
CWBS	Contract Work Breakdown Structure
CZCS	Coastal Zone Color Scanner
DAAC	Distributed Active Archive Center
DADS	Data Archive and Distribution System
DAR	Data Acquisition Request
DBM	Data Base Management
DBMS	Data Base Management System
DEM	Digital Elevation Model
DID	Data Item Description
DIS	Draft International Standard
DMSP	Defense Meteorological Satellite Program
DoD	Department of Defense
DOM	Dissolved Organic Matter
DPM	Deputy Project Manager
DPP	Data Pedigree Review
DSA	Directory System Agent
DSN	Deep Space Network
Ecom	EOS Communications
ECMWF	European Centre for Medium Range Weather Forecasts
ECS	EOSDIS Core System
EDC	EROS Data Center
EDOS	EOS Data and Opeations System
EGCM	Eddy-resolving General Circulation Model
EMOWG	EOS Mission Operations Working Group
EOC	EOS Operations Center
EOS	Earth Observing System

EOSAT	Earth Observing Satellite Company
EOSDIS	Earth Observing System Data and Information System
EOSP	Earth Observing Scanning Polarimeter
EPDS	Earth Probe Data System
ERIM	Environmental Research Institute of Michigan
EROS	Earth Resources Observation System
ERS	Earth Remote-sensing Satellite
ESA	European Space Agency
ESDIS	Earth Science Data and Information System
ESN	EOSDIS Science Network\
ETM	Engineering Test Model
FAR	Federal Acquisition Regulation
FASINEX	Frontal Air Sea Interaction Experiment
FDF	Flight Dynamics Facility
FGGE	First Garp Global Experiment
FIFE	First ISLSCP Field Experiment
FIPS	Federal Information Publication Standard
FIRE	First ISCCP Regional Experiment
FLI	Fluorescence Line Imager
FOS	Flight Operations Segment
FOT	Flight Operations Team
FOV	Field of View
FSMS	File and Storage Management System
FST	Field Support Terminal
FTAM	File Transfer Access Method
FTP	File Transfer Protocol
GAC	Global Aera Coverage
GAO	General Accounting Office
GB	GigaByte (10^9)
GCDIS	Global Change Data and Information System
GCMD	Global Change Master Directory

GEOSAT	Geodetic Satellite (Navy)
GEWEX	Global Energy and Water Cycle Experiment
GFE	Government Furnished Equipment
GHB	Goddard Handbook
GISS	Goddar Institute for Space Studies
GLA	Goddar Laboratory for Atmospheres
GLM	Geostationary Meteorological Satellite
GLOBAL	Global Backscatter Experiment
GMS	Geostationary Meterological Satellite
GN	Ground Network
GOES	Geostationary Operational Environmental Satellite
GOMR	Global Ozone Monitoring Radiometer
GOSIP	Government Open System Interconnection Profile
GPS	Global Positioning System
GSFC	Goddard Space Flight Center
GWE	Global Weather Experiment
HAPEX	Hydrological Atmospheric Pilot Experiment
H/W	Hardware
HiRDLS	High-Resolution Dynamics Limb Sounder
HIRS	High-Resolution Image Spectrometer
HIS	High-Resolution Interferometer Sounder
HRPT	High-Resolution Picture Transmission
HVAC	High Voltage Alternating Current
I&T	Integration and Test
IAS	Instrument Activity Specification
IATO	Independent Acceptance Test Organization
ICC	Instrument Control Center
ICD	Interface Control Document
ICF	Instrument Control Facility
ICN	International Communications Network
IDB	Instrument Data Base

IDR	Incremental Design Review
IEEE	Institute of Electrical and Electronics Engineering
IEEE-CS	Institute of Electrical and Electronics Engineering – Computer Science
IERS	International Earth Rotation Service
II	Interdisciplinary Investigator
ILS	Integrated Logistics Support
ILSMT	Integrated Logistics Support Management Team
IMS	Information Management System
IMSL	International Mathematical and Statistical Libraries
IOSDL	Institute of Oceanagraphic Sciences Deacon Laboratory
IP	International Partner
IRD	Interface Requirement Document
ISAR	Instrument Support Activity Request
ISCCP	International Satellite Cloud Climatology Project
ISO	International Standards Organization
IST	Instrument Support Terminal
ITIR	Intermediate and Thermal Infrared Radiometer
IV&V	Independent Verification and Validation
IWG	Investigator Working Group
JERS	Japanese Earth Remote-sensing
JGOFS	Joint Global Ocean Flux Study
JPL	Jet Propulsion Laboratory
Kbps	Kilobits Per Second
km	kilometer
KSA	Ku-band Single Access
LAI	Leaf Aera Index
LAN	Local Area Network
LANDSAT	Land Remote Sensing Satellite
LaRC	Langley Research Center
LCC	Life Cycle Costing
LIDAR	Light Detection and Ranging Instrument

LIMS	Limb Infrared Monitor of the Stratosphere
LINPAC	Linpack (Linear Algebra Package)
LIS	Lightning Imaging Sensor
LRU	Line Replaceable Unit
LSM	Local System Management
LTIP	Long Term Instrument Plan
LTSP	Long Term Science Plan
M&O	Maintenance and Operations
MA	Multiple Access
MAC	Medium Access Control
MASEX	Mass Air Sea Transfer Experiment
MB	MegaByte (10^6)
MBps	Millions of Bytes per Second
Mbps	Megabits per second
MDT	Mean Down Time
METSOAT	European Weather Satellite
MFD	Master File Directory
MFLOPS	Million Floating Point Operations per Second
MHS	Microwave Humidity Sounder
MILNET	Military Network
MIMR	Multifrequency Imaging Microwave Radiometer
MISR	Multi-angle Imaging Spectro-Radiometer
MIZEX	Marginal Ice Zone Experiment
MLS	Microwave Limb Sounder
MO&DSD	Mission Operations and Data Systems Directorate
MODIS-N	Moderate-Resolution Imaging Spectrometer – Nadir
MODIS-T	Moderate-Resolution Imaging Spectrometer – Tilt
MOM	Mission Operations Manager
MOPITT	Measurements of Pollution in the Troposphere
MOS	Marine Observation Satellite
MOTIS	Message Oriented Text Interchange System

MOU	Memorandum of Understanding
MS	Mass Storage
MSFC	Marshall Space Flight Center
MSR	Monthly Status Review
MSS	Multi-Spectral Scanner
MSU	Microwave Sounding, Unit,Mass Storage Unit
MTBCM	Mean Time Between Corrective Maintenance
MTBF	Mean Time Between Failure
MTBM	Mean Time Between Maintenance
MTBPM	Mean Time Between Preventive Maintenance
MTTR	Mean Time To Repair
NARA	National Archives and Records Administration
NASA	National Aeronautics and Space Administration
NASDA	Japanese National Space Agency
NATO ASI	North Atlantic Treaty Organization Advanced Study Institutes
NCC	Network Control Center
NCDC	National Climatic Data Center (NOAA)
NCDS	NASA Climate Data System (GSFC)
NCSL	National Computer Systems Laboratory
NDVI	Normalized Difference Vegetation Index
NESDIS	National Environmental Satellite, Data, and Information Service (NOAA)
NEXRAD	Next Generation Radar
NGDC	National Geophysical Data Center (NOAA)
NHB	NASA Handbook
NHC	National Hurricane Center
NIST	National Institute of Standards and Technology
NMC	National Meterological Center (NOAA)
NMI	NASA Management Instruction
NOAA	National Oceanic and Atmospheric Administration
NODC	National Oceanographic Data Center (NOAA)
NODS	NASA Ocean Data System (JPL)

NREN	National Research and Education Network
NRP	National Resource Protection
NSA	National Security Agency
NSCAT	NASA Scatterometer
NSF	National Science Foundation
NSI	NASA Science Internet
NSIDC	National Snow and Ice Data Center
NSN	NASA Science Net
NSSDC	National Space Science Data Center
NWS	National Weather Service
O/A	Orbit and Attitude
OBC	OnBoard Computer
OCM	Ocean Color Mission
OCT	Ocean Color and Temperature
ODC	Other Data Center
OJT	On-the-Job Training
OMB	Office of Management and Budget
ORNL	Oak Ridge National Laboratory
ORNL	Oak Ridge National Laboratory
OSI	Open Systems Interconnection
PA	Product Assurance
PAIP	Performance Assurance Implementation Plan
PAR	Performance Assurance Requirements
PDB	Project Data Base
PDL	Program Design Language
PDR	Preliminary Design Review
PGS	Product Generation System
PI	Principal Investigator
PI/TL	Principal Investigator/Team Leader
PLDS	Pilot Land Development System
PM	Preventive Maintenance

PMR	Project Management Review
PMS	Performance Measurement System
PMSR	Performance Measurement Status Report
POSIX	Portable Operating System Interface for Computer Environments
PRR	Program Requirements Review
PSAT	Predicted Site Acquisition Table
PSCN	Program Support Communications Network
PSU	Pennsylvania State University
QA	Quality Assurance
QAR	Quality Assurance Representative
RADARSAT	Radar Satellite (Canadian)
RFC	Request For Change
RID	Review Item Discrepancy
RIR	Release Initiation Review
RMA	Reliability, Maintainability, Availability
RMP	Risk Management Panel
RRR	Release Readiness Review
SA	Single Access
SAGE III	Stratospheric Aerosol and Gas Experiment III
SAM	Stratospheric Aerosol Measurement, System Assurance Manager
SAP	Software Assurance Plan
SAS	Statistical Analysis System
SASS	Seasat A Scatterometer System
SBUV	Solar Backscatter Ultraviolet
SCANSCAT	Scatterometer (Dual pencil-beam), Advanced Scatterometer for Studies in Meteorology and Oceanography
SCAR	Spacecraft Core Activity Request
SCC	**Spacecraft Control Computer**
SCF	Science Computing Facility
SDB	**Spacecraft Data Base**
SDPS	Science Data Processing Segment
SDR	System Design Review

SDSD	Satellite Data Services Division (NOAA)
SEASAT	Sea Satellite
SeaWiFS	Sea-viewing Wide Field of View Sensor
SEDAC	Socio-Economic Data and Applications Center
SIR-B	Shuttle Imaging Radar-B
SIR-C	Spaceborne Imaging Radar-C
SIRD	Support Instrumentation Requirements Document
SLAR	Side Looking Airborne Radar
SMAP	Software Management and Assurance Program
SMC	System Management Center
SMM	Solar Maximum Mission
SMMR	Scanning Multichannel Microwave Radiometer
SN	Space Network
SOLSTICE	Solar Stellar Irradiance Comparison Experiment
SOM	Science Operations Manager
SORR	Segment Operational Readiness Review
SOW	Statement of Work
SPAN	Space Physics Analysis Network
SPAR	Software Performance Assurance Representative
SPOT	System pour l'Observation de la Terre (France)
SPSS	Statistical Package for the Social Sciences
SRR	System Requirements Review
SSA	S-band Single Access
SSM/I	Special Sensor for Microwave Imaging
SST	Sea Surface Temperature
SSU	Stratospheric Sounding Unit
STA	Space Technology Agency (Japan)
STDN	Satellite Tracking and Data Network
STGT	Second TRDS Ground Terminal
STIP	Short Term Instrument Plan
STOP	Short Term Operations Plan

STREX	Storms Response Experiment
SW/LW	Software/Long Wave
TAG	Technical Assistance Group
TB	Terabyte (10^{12})
TBD	To Be Determined
TDRS	Tracking and Data Relay Satellite
TDRSS	Tracking and Data Relay Satellite System
TEM	Terrestrial Ecosystem Model
TES	Tropospheric Emission Spectrometer
TGM	Trace Gas Model
THIR	Temperature Humidity Infrared Radiometer
TIP	Technical Information Program
TIROS	Television Infrared Operational Satellite
TL	Team Leader
TM	Team Member
TMR	Topex/Poseidon Microwave Radiometer
TOGA	Tropical Ocean Global Atmosphere
TOMS	Total Ozone Mapping Spectrometer
TONS	**TDRSS On-Board Navigation System**
TOO	Target of Opportunity
TOPEX	Topography Experiment
TOVS	TIROS Operational Vertical Sounder
TRMM	Tropical Rainfall Measuring Mission
TRR	Test Readiness Review
TW	**Target Week**
UAF	University of Alaska at Fairbanks
UARS	Upper Atmosphere Research Satellite
UAV	User Antenna View
UC	University of California
UK	United Kingdom
UNESCO	United Nations Educational Scientific and Cultural Organization

UPS	Uninterruptible Power Supply
USDA	United States Department of Agriculture
USGS	U.S. Geological Survey
USN	United States Navy
UT	**Universal Time**
UTC	**Universal Time Coordinate**
UWA	University of Washigton
UWI	University of Wisconsin
VAS	VISSR Atmospheric Sounder
VLBI	Very Long Baseline Interferometer
WBS	Work Breakdown Structure
WOCE	World Ocean Circulation Experiment
WPL	Wave Propagation Laboratory (NOAA)
WSGT	White Sands Ground Terminal
WTS	**Wallops Tracking Station**

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Appendix C. Data Volumes and Assumptions

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1. Introduction

The purpose of this appendix is to define the processing, storage, and data communication requirements for the ECS, and to describe those assumptions and methodologies that were made in science data processing requirements calculations.

It should be noted that the EOS-A1 data products sizing information, has not been updated in this appendix to reflect the updated series of EOS platforms. Since these products are still under review, the current tables are unchanged from the original EOS-A1 values.

2. Assumptions

2.1 Daily Data Volume

The table for Daily Data Volume contains information on the EOSDIS baseline volume estimates anticipated at the launch of EOS-A1. The volume estimates are for the at-launch standard data products as identified by the Facility and Principal Investigator (PI) instrument teams. The at-launch standard data products, also referred to as the core data products, are the products that can be generated shortly after launch.

Post-launch data products are those which are expected to be developed and archived as standard products after launch as a result of post-launch research. For the purpose of deriving aggregate storage requirements it is estimated that post-launch "product growth" will require an additional 20% (non-compounding) of the at-launch storage requirements each year after launches.

It must be noted that the table does not include the estimate for reprocessing or quick look data storage and generation. Volume estimates for Interdisciplinary Investigators (IIs) data products are separately presented in Table C-14. The volume estimates were made, assuming that all input data required by IIs would be available for their studies. It is important to note that many IIs require data products from instruments not to be flown on EOS-A1 (e.g., HIRIS and SAR). Furthermore, EOS data products need to be carefully analyzed and validated by instrument teams before they are used for IIs' studies.

Specific assumptions used in volume estimates are described below.

2.1.1 Level 0

Daily data volumes for all instruments were computed from average data rates by multiplying them with the number of seconds in a day and converting to daily data volumes in giga-bytes. Average data rates instead of peak data rates were used in computations.

2.1.2 Level 1A

In estimating Level 1A, it was assumed that packed raw data would be unpacked and each sample of data would requires 16 bits. In addition, 10% overhead was added for housekeeping data, header and calibration information.

2.1.3 Level 1B

For Level 1B, data volume estimates by investigators in their proposals and the Conceptual Design and Cost Review (CDCR) presentations(available at the EOS Library) were used, if specific information was available (see Section 3.3). Otherwise, it was assumed that Level 1B volume would be the same as Level 1A.

2.1.4 Level 2

As for Level 1B, the volume estimates by instrument teams in their proposals and the CDCR presentations were used, if specific information was available. If no information was available, the data volumes were estimated, based on the information on standard data products compiled by the SPSO. Instruments based on the estimates by instrument teams include: CERES, EOSP, MISR, and MOPITT. Data volumes for MODIS-N/T were based on the estimates by the MODIS Data Study Team but modified to reflect the changes in spatial resolution of MODIS-N.

In estimating Level 2 data volume, a maximum number of pixels per day was first determined for a given spatial resolution, spacecraft speed, swath width, and duty cycle of instrument. Then an effective number of pixels per day for each product was computed by multiplying the maximum number of pixels by the fractional coverage according to surface type, assuming that each data product would be produced only for the corresponding surface type (i.e., SST will be determined only over oceans and NDVI will be computed over land areas). For a data product (e.g., temperature and humidity profiles from AIRS/AMSU) which is a function of altitude (or pressure), the number of levels was also considered in determining the effective number of pixels. It was also considered whether each data product is for daytime only or subject to cloud filtering. Fractional coverages of surface types used in volume estimates are: 0.3 for land area, 0.7 for oceans, 0.18 for land snow/ice, and 0.13 for sea ice. A fractional coverage of 0.5 was assumed for cloud covered area and the daytime portion of an orbit. The Level 2 data volumes were computed by multiplying the effective number of pixels by 4 bytes (2 bytes for retrieved parameter value and 2 bytes for error estimates), with the exception of certain data products such as atmospheric-corrected radiances which were assumed to be stored as a 2-byte word. Then 10% overhead was added to the computed volumes to obtain the final Level 2 volume estimates.

2.1.5 Level 3

The volume estimates by instrument teams in their proposals and Conceptual Design and Cost Review (CDCR) presentations were used, if specific information was available. Instruments based on the estimates by instrument teams include: CERES, MISR, and MOPITT. For MIMR, it was assumed that all data products proposed for HIMSS would be produced and a volume estimate by the HIMSS team was used. For other instruments, the data volumes were estimated, based on the spatial and temporal resolutions of the proposed standard data products.

First the number of equal-area grid points for a given data product was determined from the known spatial resolution and earth's surface area. The Earth's surface area was calculated, using a mean radius of 6,371 km. Then the number of grid points was adjusted for the surface type for the data product by multiplying by an appropriate fraction. For certain atmospheric data products of which horizontal resolutions were given in degrees of latitude and longitude, the number of grid points was determined, assuming an equal-angle grid. For a data product which is a function of altitude (or pressure), the number of levels was considered in determining the total number of grid points.

The Level 3 data volumes were estimated, assuming that each grid point would have three associated values (mean, standard deviation, and number of observations), each being a 2-byte word and considering the temporal resolution of the data product. The final Level 2 volumes were obtained by adding 10% overhead.

2.1.6 Browse Data

Volume for browse data was estimated, assuming 5% of Level -1B, -2, and -3 data volume.

2.1.7 Metadata

Volume for metadata was calculated by multiplying the number of granules by the estimated meta-data length of 2000 bytes. Estimated length of each attribute is given in the Metadata Attribute tables (C-10 and C-11). The Metadata Attributes tables are preliminary and subject to change as additional information about EOS data products become available. The Core Metadata Attributes are the minimum set of attributes necessary for the inventory purpose. The Data Set Specific Metadata Attributes represent a set of attributes required to describe instruments and geophysical parameters. The record length of a metadata could be obtained by adding the lengths of two types of attributes, the Core Metadata Attributes and the Data Set Specific Metadata Attributes.

2.2 Data Granules

A data granule is defined as the smallest piece of data for which the EOSDIS will process, archive, store metadata, and track a given data product. In defining data granules for data products from the EOS-A1 instruments, the following assumptions were made:

2.2.1 Level-0, -1A, -1B and -2 Data Products

For low data rate instruments and some of high data rate instruments of which Level 1B data volume is much smaller than that for Level 1A, one orbit was assumed to be one data granule. Instruments in this category include: ACRIM, AMSU-A/MHS, HIRDLS, CERES, EOSP, MIMR, MISR, MOPITT and STIKSCAT.

For high data rate instruments, one data granule was assumed to be equivalent to one scene which varies, depending upon instrument. The scenes for high data rate instruments were defined as follows:

AIRS: 2330 km (cross-track) x 2166 km (along-track) box, the area covered by 120 scans (320.4 seconds).

ASTER:	60 km (cross-track) x 60 km (along-track) box, the area covered by 8.9 seconds of observation. The number of granules was determined by assuming 16% duty cycle.
MODIS-N/T:	Area covered by 237.5 seconds of observations, equivalent to 50 MODIS-T scans. For MODIS-N, one scene is define as an area of 2330 km (cross-track) x 1605 km (along-track) box. One scene for MODIS-T covers 1502 km (cross-track) x 1605 km box.

2.2.2 Level 3 Data Product

For most of instruments one granule per day was assumed. As for Level 2 data products, a day's worth of data for each discipline was defined as one granule if multi-disciplinary data products were expected.

2.3 Allocation of Data Products

Data products from the EOS-A1 instruments were allocated to seven (7) active archive data centers: Goddard Space Flight Center (GSFC), Jet Propulsion Laboratory (JPL), EROS Data Center (EDC), NASA Langley Research Center (LaRC), National Snow and Ice Data Center (NSIDC), Marshall Space Flight Center (MSFC), and Alaska SAR Facility (ASF) at the University of Alaska - Fairbanks.

Grouping of data products was based on NASA Headquarters program guidance, which took into account local scientific expertise in the use of the data, institutional commitment and supporting infrastructure. The following allocations were made:

GSFC:	Atmospheric Dynamics, Global Biosphere, Geophysics, and Upper Atmosphere
JPL:	Ocean Circulation and Air-Sea Interactions
EDC:	Land Processes
LaRC:	Radiation Budget, Aerosols, and Tropospheric Chemistry
NSIDC:	Cryosphere(Non-SAR)
MSFC:	Hydrology
ASF:	Sea Ice (SAR)

Based on these allocations, the following assignments of data products from EOS instruments were made:

GSFC:	All products from ACRIM, AIRS/AMSU, HIRDLS, MISR, and MODIS-T. L1 and L2/3 atmospheric and ocean products from MODIS-N.
JPL:	All products from STIKSCAT.
EDC:	L2/3 land products from MODIS-N (L2 products will be generated at GSFC, but will be archived and distributed by EDC). L1 and L2/3 land products from ASTER.
LaRC:	All products from CERES, EOSP, and MOPITT.

NSIDC:	L2/3 snow/ice products from ASTER and MODIS-N.
MSFC:	All products from MIMR and LIS.
ASF:	No data product from instruments on EOS-A1.

2.4 Ancillary and Correlative Data

The volume estimates by instruments teams in their proposals and Conceptual Design and Cost Review (CDCR) presentations were used, if specific information was available. Volume for ancillary data was estimated, assuming 20% of the at-launch data product volume and considering the fractional coverage of the earth's surface. For correlative data, 10% was assumed. The same percentages (20% and 10%) were applied to non-EOS ancillary and correlative data. Volume for in-situ correlative data was estimated, assuming that for a year one month worth of data would be needed for validation and calculating a daily data volume.

2.5 Landsat-7 Storage Requirements

The storage provided at EDC for Landsat 7 includes a 30 day buffer for the storage of products being distributed to users. The buffer is sized for 160 scenes per day with a total size of 108 Gbytes per day. Therefore, the 30 day buffer is sized at 3.3 Tbytes. In addition to the 30 day buffer, storage is provided for the permanent archive of metadata for 420 scenes per day and browse products (14 Gbytes per day) for the 420 scenes (5% of total scene volume).

2.6 ORNL Storage Requirements

The total archive storage required at ORNL is a total of 5 Tbytes. This storage is provided to support the following:

a) **Field campaigns that occur as follows:**
   - **One large campaign every 4 to 5 years at 1 Tbyte each;**
   - **One medium campaign every 2 to 3 years at .1 Tbyte each; and**
   - **One small campaign every year at .01 Tbyte each.**

b) **Storage for the LaRC Tropospheric Chemistry Campaigns is 1.2 Tbytes.**

c) **Storage for existing data is 0.2 Tbytes.**

In addition the IMS metadata storage provided at ORNL is sized to receive an average of 2500 granules per day.

3. Source of Information

3.1 Payload Allocation

EOS-A1 payload information is based on the 18 January 1991 announcement by NASA Headquarters. Fourteen (14) instruments were selected for flight on the first satellite of the EOS-A1. It includes: AIRS, AMSU-A/MHS, ASTER, CERES, EOSP, HIRDLS, LIS, MIMR, MISR, MODIS-N/T, MOPITT, and STIKSCAT. Selection of MIMR is conditional, pending resolution of technical issues. In addition, a Wide-Band Data Collection System (WBDCS) is included on

EOS-A1 as a capability of the satellite platform. Although WBDCS is initially designed for seismic purpose, it will support the collection of global in situ data.

HIRIS was confirmed for development and tentative selection for subsequent flight. ACRIM was selected for flight on a Satellite of Opportunity (SO).

3.2 Data Rates and Instrument Characteristics

Average instrument data rates used in the volume estimates were obtained from the EOS Project Office.

3.3 Data Volumes

Some of the AO and the Phase C/D proposals and Conceptual Design and Cost Review (CDCR) presentations by instrument teams provide detailed information on data volume. Whenever such information was available, estimates from instrument teams were used. The instrument teams, providing volume information, include: CERES, EOSP, MISR and MOPITT. For Level 2/3 MIMR products, it was assumed that all data products proposed for HIMSS would be produced from MIMR and the estimates from the HIMSS team were used.

Information on volume for the NOAA ancillary and correlative data is based on NOAA Polar Orbiter Data Users Guide, NOAA/NESDIS, December, 1986.

3.4 At-launch Standard Data Products

The EOS data product database is based on the SPSO's preliminary version of the EOS Output Data Products and Input Requirements document (April 1991 Version) for the facility instruments, Principal Investigator (PI) instruments and Interdisciplinary Investigators as compiled by Drs. Vincent Salomonson (NASA/GSFC), James Russell (NASA/LaRC), and JoBea Way (NASA/JPL). The database was updated, based on the Phase C/D proposals and Conceptual Design and Cost Review (CDCR) presentations.

3.5 Ancillary and Correlative Data

Ancillary and correlative data for PI instruments were based on the Report on PI Instruments compiled by James Russell and presented during the 18 January 1990 IWG Meeting. Information on non-EOS data was obtained from the database based on the AO proposals and compiled by the SPSO.

Information on ancillary and correlative data for facility instruments was based on Weekly MODIS Data Study Team Reports, the SPSO maintained database, and the JPL Instrument Data and Control System (IDACS) document.

3.6 Processing Requirements

The primary source of information for processing requirements was the AO proposal. Estimates based on the AO proposals were updated when additional information became available.

Estimates for MOPITT were updated, using the Conceptual Design and Cost Review (CDCR) presentation. Estimates for MODIS-N/T were based on the information compiled and provided by the MODIS Data Study Team. For MIMR, it was assumed that all the products proposed for HIMSS would be produced by the MIMR Team and the estimates by the HIMSS team were used.

Processing requirements for 3 facility instruments (AIRS, AMSU and ASTER) were estimated, using the data product information compiled by the SPSO. In estimating processing requirements, an effective number of pixels (per day) for each data product was determined after considering the fraction of daylight (50%), ocean (70%), land (30%) and cloud (50%). Processing load estimate were calculated by multiplying the total number of pixels by an estimated number of operations per pixel and then converting it to the Millions of Floating Point Operations per Second (MFLOPS). Number of operations per pixel required for each data product was largely based on the information compiled by the MODIS Data Study Team. Processing requirement for ASTER Level 1 data products was not computed, assuming that Japan, not the EOSDIS, would be responsible for Level 1 data production. For the purpose of deriving aggregate processing power requirements it is estimated that post-launch "product growth" will require an additional 20% (non-compounding) of the at-launch processing power each year after launches.

Only one standard Level 4 product is currently identified to be produced at launch. This global data assimilation and modelling product will be produced at the GSFC DAAC by Dr. Ray Bates, et al. The algorithm suite which produces this product will be based on programs which have been running for some time on a CDC Cyber 205 with two vector pipes (making extensive use of its 32-bit floating point capability). These programs require one-and-a-half hours on the Cyber to produce one day of output data at a 4^{o} by 5^{o} surface resolution at 9 altitudes. The desired resolution for EOS is 0.5^{o} by 0.5^{o} at 50 altitudes which is expected to require 750 times as many FLOPS. The volume of standard products output is estimated to be 2 GB/day.

3.7 Volume Estimates for II Level 4 Data Products

Volume estimates for II output data products were based on the AO proposals and questionnaires. When only total volumes were given, daily data volumes were computed, assuming 5 years of research. For investigators who did not provide any information on data volumes, data volumes for their output products were estimated, using the information compiled by the SPSO.

Table C-1: Daily Data Volume

PLATFORM	INSTRUMENT	TYPE	DATA RATE (Kbps)	DATA VOLUME (GB/day) L-0	L-1A	L-1B	L-2	L-3	TOTAL VOLUME
EOS-A1	**AIRS**	FI	2000.0	21.600	31.680	31.680	0.518	0.238	**85.717**
	AMSU-A/MHS	FI	7.4	0.080	0.117	0.117	0.059	0.029	**0.402**
	ASTER	FI	8300.0	89.640	131.472	131.472	26.615	1.455	**380.654**
	CERES	PI	20.0	0.216	0.317	0.317	0.094	0.454	**1.397**
	EOSP	PI	44.0	0.475	0.697	0.697	0.353	0.007	**2.229**
	HIRDLS	PI	35.0	0.378	0.554	0.554	0.028	0.007	**1.521**
	LIS	PI	6.0	0.065	0.095	0.095	0.000	0.000	**0.255**
	MIMR *	PI	62.0	0.670	0.982	0.982	0.685	0.713	**4.032**
	MISR	PI	161.0	1.739	2.550	1.656	0.147	0.116	**6.207**
	MODIS-N	FI	5400.0	58.320	85.536	85.536	46.885	7.783	**284.059**
	MODIS-T	FI	1500.0	16.200	23.760	23.760	30.702	6.760	**101.181**
	MOPITT	PI	5.0	0.054	0.079	0.079	0.006	0.001	**0.219**
	STIKSCAT	PI	5.2	0.056	0.082	0.082	0.008	0.001	**0.229**
	WBDCS	FI	512.0	5.530					**5.530**
	ACRIM	PI	1.0	0.011	0.016	0.016	0.008	0.004	**0.054**
	TOTAL (EOS - A)		**18058.6**	**195.033**	**277.938**	**277.043**	**106.106**	**17.566**	**873.686**
OTHERS	**EOS-SAR**	FI	20000.0	216.000	316.800	28.200	14.100	7.050	**582.150**
	TRMM	EP	163.0	1.760	7.604	3.859	4.007	0.454	**17.684**

* *Acceptance of these instruments is conditional, pending resolution of technical issues.*

Note: Total volume does not necessarily represent EOSDIS archival data volume.

Table C-2: Number of Data Products By Discipline

PLATFORM	INSTRUMENT	LEVEL 1 TOTAL	LEVEL 2 ATMOS	LEVEL 2 OCEAN	LEVEL 2 LAND	LEVEL 2 CRYOSPHERE	LEVEL 2 OTHERS	LEVEL 2 TOTAL
EOS-A1	AIRS	**2**	44	3	2	2		**51**
	AMSU-A/B	**2**	1					**1**
	ASTER	**2**	17	6	15	2		**40**
	CERES	**2**	22					**22**
	EOSP	**2**	6					**6**
	HIRDLS	**2**	16					**16**
	LIS	**2**						**0**
	MIMR *	**2**	2	7	4	5		**18**
	MISR	**2**	5	1	5			**11**
	MODIS-N	**2**	13	2	4	1	2	**22**
	MODIS-T	**2**		11			1	**12**
	MOPITT	**2**	2					**2**
	STIKSCAT	**2**		2				**2**
	ACRIM	**2**	1					**1**
	TOTAL (EOS - A1)	**28**	**129**	**32**	**30**	**10**	**3**	**204**
OTHER	EOS-SAR	**2**		6	18	8		**32**

PLATFORM	INSTRUMENT	LEVEL 3 ATMOS	LEVEL 3 OCEAN	LEVEL 3 LAND	LEVEL 3 CRYOSPHERE	LEVEL 3 OTHERS	LEVEL 3 TOTAL	TOTAL (LEVEL 1-3)
EOS-A1	AIRS	20	6	8	2		**36**	**89**
	AMSU-A/MHS	1					**1**	**4**
	ASTER			6			**6**	**48**
	CERES	10					**10**	**34**
	EOSP	5					**5**	**13**
	HIRDLS	16					**16**	**34**
	LIS						**0**	**2**
	MIMR *		7	4	5		**16**	**36**
	MISR	10	2	10			**22**	**35**
	MODIS-N	26	10	18	2		**56**	**80**
	MODIS-T		27				**27**	**41**
	MOPITT	2					**2**	**6**
	STIKSCAT		3				**3**	**7**
	ACRIM	1					**1**	**4**
	TOTAL (EOS - A1)	**91**	**55**	**46**	**9**	**0**	**201**	**433**
OTHER	EOS-SAR		6	18	8		32	**66**

* *Acceptance of this instrument is conditional, pending resolution of technical issues.*

Table C-3: Number of Granules Per Day

PLATFORM	INSTRUMENT	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	TOTAL
EOS-A1	AIRS	270	540	810	3	**1623**
	AMSU-A/MHS	15	30	15	1	**61**
	ASTER	1558	3116	6232	34	**10940**
	CERES	15	30	15	2	**62**
	EOSP	15	30	15	1	**61**
	HIRDLS	15	30	15	1	**61**
	LIS	15	30	15	1	**61**
	MIMR *	15	30	45	3	**93**
	MISR	15	30	15	1	**61**
	MODIS-N	364	728	2002	10	**3104**
	MODIS-T	182	364	364	11	**921**
	MOPITT	15	30	15	1	**61**
	STIKSCAT	15	30	15	1	**61**
	ACRIM	15	30	15	1	**61**
	TOTAL (EOS - A1)	**2524**	**5048**	**9588**	**71**	**17231**
OTHERS	TRMM	80	180	106	1	**367**
	EOS-SAR	216	432	108	54	**810**

* *Acceptance of this instrument is conditional, pending resolution of technical issues.*

Table C-4: EOS Instrument Allocation

Instrument	DAACs						
	GSFC	JPL	EDC	LaRC	NSIDC	ASF	MSFC
ACRIM	L1 - L3						
AIRS	L1 - L3						
AMSU-A/MHS	L1 - L3						
ASTER			L2-L3 (LND)		L2-L3(Snow/Ice)		
CERES				L1 - L3			
EOSP				L1 - L3			
HIRDLS	L1 - L3						
LIS							L1 - L3
MIMR **							L1 - L3
MISR	L1 - L3						
MODIS-N	L1 - L3		L2-L3 (LND) *		L2-L3(Snow/Ice)		
MODIS-T	L1 - L3		L2-L3 (LND)				
MOPITT				L1 - L3			
EOS-SAR		L2-L3 (OCE)	L1-L3 (LND)		L2-L3(Snow/Ice)	L2-L3(Sea Ice)	
STIKSCAT		L1 - L3					
NO OF INST.	*7*	*2*	*4*	*3*	*3*	*1*	*2*

* *MODIS-N L2 land data products will be produced at GSFC, but EDC will be responsible for their archival and distribution.*

** *Acceptance of this instrument is conditional, pending resolution of technical issues.*

Table C-5: Data Storage Volume By DAAC for EOS-A1, TRMM, and EOS-SAR

Level	Platform	DAACs							Total
		GSFC	JPL	EDC	LaRC	NSIDC	ASF	MSFC	(GB/day)
Level 0	EOS - A1	103.879	0.056	89.640	0.745			0.734	**195.054**
	TRMM	1.739							**1.739**
	EOS-SAR			216.000					**216.000**
Level 1	EOS - A1	287.597	0.165	262.944	2.186			2.154	**555.046**
	TRMM	11.399							**11.399**
	EOS-SAR			345.000					**345.000**
Level 2	EOS - A1	71.046	0.008	28.316	0.452	5.759		0.541	**106.122**
	TRMM	4.071							**4.071**
	EOS-SAR		2.644	7.931		1.322	2.203		**14.100**
Level 3	EOS - A1	13.680	0.001	2.707	0.462	0.162		0.563	**17.574**
	TRMM	0.446							**0.446**
	EOS-SAR		1.322	3.966		0.661	1.102		**7.051**
Browse Data	EOS - A1	11.423	0.005	8.125	0.100	0.296		0.109	**20.058**
	TRMM	0.514							**0.514**
	EOS-SAR		0.198	8.125		0.099	0.165		**8.587**
Meta Data	EOS - A1	0.014	0.004	0.015	0.000	0.004		0.000	**0.037**
	EOS-SAR			0.001					**0.001**
Obs. Oper. History Data	EOS - A1	1.000							**1.000**
All Data	EOS - A1	488.638	0.237	391.747	3.945	6.222		4.102	**894.891**
	TRMM	18.168							**18.168**
	EOS-SAR		4.164	581.023		2.082	3.470		**590.739**

Table C-6: Ancillary Data Dependencies

OUTPUT PRODUCTS	ANCILLARY DATA																				
	EOS														NON-EOS						
	AIRS-L1B	AIRS-L2	AMSU-L1B	ASTER-L1B	ASTER-L2	CERES-L2	EOSP-L2	MIMR-L1B	MIMR-L2	MISR-L2	MODIS-N-L1B	MODIS-N-L2	MODIS-T-L2	STIKSCAT-L2	AVHRR-L1B	AVHRR-L2	ECMWF DATA	FNOC DATA	GOES-L1B	GOMR-L2	NMC DATA
AIRS - L2			X																		X
ASTER - L2		X								X						X				X	
CERES - L2		X						X			X				X			X	X		X
EOSP - L2											X										
HIRDLS - L2	X	X	X				X				X										X
LIS -L1B		X							X			X									
MISR - L2		X			X	X	X					X									
MODIS N/T - L2		X							X	X				X				X		X	X
MOPITT - L2	X	X	X	X		X					X										
STIKSCAT - L2								X	X												
EOS-SAR-L2												X	X								

Table C-7: Level 1B Data Traffic *

PLATFORM	DESTINATION	SOURCE										TOTAL
		EOS							NON-EOS			
		GSFC	EDC	JPL	LaRC	NSIDC	ASF	MSFC	NESDIS	NMC		(GB/day)
EOS - A1	GSFC									0.001		0.001
	EDC											
	JPL							0.179				0.179
	LaRC	16.330						0.179	0.511			17.019
	NSIDC	4.150										4.150
	ASF											
	MSFC											
	TOTAL	20.480						0.357	0.511	0.001		21.349

* *Table does not include correlative data*

Table C-8: Level 2/3 Data Traffic *

PLATFORM	DESTINATION	SOURCE										TOTAL
		EOS							NON-EOS			
		GSFC	EDC	JPL	LaRC	NSIDC	ASF	MSFC	NESDIS	NMC		(GB/day)
EOS - A1	GSFC		0.009	0.001	0.011			0.034		0.058		0.113
	EDC	6.422							0.003	0.009		6.434
	JPL											
	LaRC	0.790										0.790
	NSIDC											
	ASF											
	MSFC	0.058										0.058
	TOTAL	7.270	0.009	0.001	0.011			0.034	0.003	0.067		7.395

* *Table does not include correlative data*

Table C-7-SAR: Level 1B Data Traffic *

PLATFORM	DESTINATION	SOURCE										
		EOS							NON-EOS			TOTAL (GB/day)
		GSFC	EDC	JPL	LaRC	NSIDC	ASF	MSFC	NESDIS	NMC	ECMWF	
EOS - SAR	GSFC											
	EDC											
	JPL		14.100									14.100
	LaRC											
	NSIDC		2.820									2.820
	ASF		8.460									8.460
	MSFC											
	TOTAL		**25.380**									**25.380**

* *Table does not include correlative data*

Table C-8-SAR: Level 2/3 Data Traffic *

PLATFORM	DESTINATION	SOURCE										
		EOS							NON-EOS			TOTAL (GB/day)
		GSFC	EDC	JPL	LaRC	NSIDC	ASF	MSFC	NESDIS	NMC	ECMWF	
EOS - SAR	GSFC											
	EDC											
	JPL											
	LaRC											
	NSIDC											
	ASF	0.104		0.092							0.001	0.197
	MSFC											
	TOTAL	**0.104**		**0.092**							**0.001**	**0.197**

* *Table does not include correlative data*

Table C-9: Volume Estimates for V0 Data Sets by DAAC

DAAC	DATA VOLUME (GB)	
	CURRENT	FY 1994
ASF *	-	14821
EDC **	-	50016
GSFC ***	4779	6214
JPL ****	37	2809
LaRC	331	524
MSFC	52	619
NSIDC	79	1194
ORNL	200	1000
TOTAL (GB)	**5478**	**77197**

* *Estimates include SAR data sets from both ERS-1 and JERS-1.*

** *Estimates include TIMS and AVIRIS data sets.*

*** *Estimate for FY94 includes UARS Level 1B data.*

**** *Estimate includes NODS holding only.*

Table C-10: Baseline Metadata Attributes

Fieldname	Bytes	Description
Algorithm Version Number		Version number & algorithm name
Archive ID		Archive location identifier
Coverage		Rect,circular, or elliptical coordinates
Data Type		Data type (ancillary, housekeeping,etc)
Footprint		Bounding shape (rect,elliptical,circ)
Geographic Location Keywords		Continent, ocean, or global location
Granule ID		Granule Identifier
Investigator		Investigator ID
Platform ID		Platform on which sensor was located
Processing Level		Level of processing
Product Sequence Number		Product identifier
Project ID		Supported project that collected the data
Sensor ID		Sensor which captured data
Start Orbit Number		Orbit number at start of data collection
Stop Orbit Number		Orbit number at end of data collection
Start Time		Date and time data collection started
Stop Time		Date and time data collection stopped
Total Bytes	**400**	

The Inventory Metadata Attributes are the minimum set of attributes necessary for an inventory entry.

Table C-11: Product Specific Meta Data Attributes

Fieldname	Bytes	Description
Attitude Information		Min & max yaw, pitch and roll
Band Quality		Indicator of band quality
Cloud Cover		Cloud cover by percentage
Data Gap		Includes orbit no.,Lat/Long, time span
Data Quality		Quality assessment of data granule
Day Night Flag		Indicates image obtained day or night
Ephemeris Information		
General Comments		General remarks
Image Description		General comments about image
Inventory Date		Date granule ingested into inventory
Land/Ocean Tag		Percentage land/ocean
Latitudional Resolution		Latitudinal gridding of the data
Longitudional Resolution		Longitudional gridding of the data
Max Geocorrected Latitude		Max latitude of the image after geocorrection
Max Geocorrected Longitude		Max longitude of the image after geocorrection
Max Satellite Zenith Angle		(-90.00 to 90.00)
Max Sun Azimuth		Max sun azimuth for the data
Max Sun Zenith		Maximum sun elevation above the horizon
Min Geocorrected Latitude		Min latitude of the image after geocorrection
Min Geocorrected Longitude		Min longitude of the image after geocorrection
Min Satellite Zenith Angle		(-90.00 to 90.00)
Min Sun Azimuth		Minimum sun azimuth for the data
Min Sun Zenith		Minimum sun elevation above the horizon
Number of Bands		Number of spectral bands
Number of Data Gaps		Number of missing lines in image
Number of Lines		Number of lines or scans in the data
Number of Observations		Number of observations included in data
Number of Samples		Number of samples or pixels in a line
Operation Mode		Description of operation mode
Parameter Information		Up to 20 parameters (20 bytes per parameter)
Processing Date		Date the product was processed
Processing Location		PGS where product processed
Scene ID		Input scene Identifier
Start Line From Original		Starting line from master scene, if subsetted
Start Pixel From Original		Starting pixel from master scene, if subsetted
Storage Medium		Storage media
Subset Flag		Indicates if the image subsetted from a master
Tilt Angle		
Total Product Specific	**1600**	
Total Baseline Metadata	**400**	
Total Inventory Record Size	**2000**	
Daily Granule Count	**18408**	**From Number of Granules Per Day Table**
Inventory Size Per Day (MB)	**70**	**Includes Reprocessing Factor of 2**
Inventory Size Per Year (GB)	**25**	
Mission Inventory Size (GB)	**375**	**15 year mission**

Table C-12: At-launch Processing Load

PLATFORM	INSTRUMENT	PROCESSING REQUIREMENTS (MFLOPS) *					
		LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	OTHERS	TOTAL
EOS-A1	AIRS	7.8	71.0	0.1		11.7	**90.6**
	AMSU-A/MHS	0.1	0.5	0.1			**0.7**
	ASTER ****		64.5	0.4			**64.9**
	CERES	0.1	12.2	0.2		11.0	**23.5**
	EOSP	0.2	20.5	0.0			**20.7**
	HIRDLS	12.7	6.4	1.3			**20.4**
	LIS	0.0	0.2				**0.2**
	MIMR **	3.0	9.0	9.0			**21.0**
	MISR	0.7	2.0	0.1			**2.8**
	MODIS-N	36.4	93.6	7.3			**137.4**
	MODIS-T	8.3	12.7	5.6			**26.7**
	MOPITT	0.1	0.5	0.0		0.0	**0.6**
	STIKSCAT	0.1	0.7	0.1			**0.9**
	ACRIM	0.0	0.0	0.0			
	TOTAL (EOS - A1)	**69.5**	**293.8**	**24.3**		**22.7**	**410.3**
TRMM	CERES	**0.5**	**27.9**	**0.2**		**11.0**	**39.6**
	LIS	**0.0**	**0.2**				**0.2**
OTHER	II ***				1500.0		**1500.0**

* *The MFLOPS shown are the long-term average rates at which science algorithms must execute floating-point operations to keep up with input data. For example, an entry of 1 MFLOPS indicates that the algorithm must execute 86.4 billion floating-point operations to produce an average day's product.*

** *Acceptance of these instruments is conditional, pending resolution of technical issues.*

*** *Interdisciplinary Investigator (See Section 3.6 of Appendix C.)*

**** *It is assumed that Japan, not the EOSDIS, will be responsible for the production of ASTER Level 1 data.*

Table C-13: At-launch Processing Load By DAAC

Platform	Level	DAACs							Total
		GSFC	JPL	EDC	LaRC	NSIDC	ASF	MSFC	MFLOPS*
EOS-A1	Level 1	66.0	0.1		0.4			3.0	**69.5**
	Level 2	186.2	0.7	63.1	33.1	2.4		8.2	**293.8**
	Level 3	14.5	0.1	0.4	0.3	1.0		8.0	**24.3**
	Level 4	11.7			11.0				**22.7**
	TOTAL	**278.4**	**0.9**	**63.6**	**44.8**	**3.4**		**19.2**	**410.3**
TRMM					**39.6**			**0.2**	**39.8**
OTHER	**II ****	1500.0							**1500.0**

* *The MFLOPS shown are the long-term average rates at which science algorithms must execute floating-point operations to keep up with input data. For example, an entry of 1 MFLOPS indicates that the algorithm must execute 86.4 billion floating-point operations to produce an average day's product.*

** *Interdisciplinary Investigator (See Section 3.6 of Appendix C.)*

Table C-14: Volume Estimates for II Level-4 Data Products

Interdisciplinary Investigator	Location of IICF	OUTPUT VOLUME (GB/day)			
		ATM	OCE	LAND	TOTAL
Abbott *	Oregon State U		0.035		**0.035**
Barron	Penn State U	0.083		0.083	**0.165**
Bates	GSFC	2.000			**2.000**
Batista/Richey	INPE, Brazil			0.115	**0.115**
Brewer *	Woods Hole Institution		0.020		**0.020**
Cihlar *	CCRS, Canada			0.105	**0.105**
Dickinson	NCAR/U of Arizona	0.165			**0.165**
Dozier	U of California			0.003	**0.003**
Grose	LaRC	0.010			**0.010**
Hansen	GISS	0.001			**0.001**
Harris	CSIRO, Australia		0.125		**0.125**
Hartmann	U of Washington	0.004			**0.004**
Isacks *	Cornell U			0.011	**0.011**
Kerr/Sorooshian	CNRS, France			2.956	**2.956**
Lau	GSFC			0.000	**0.000**
Liu	JPL		0.084		**0.084**
McNutt/Simard	CCRS, Canada		0.029	0.000	**0.029**
Moore III	U of New Hampshire	0.000			**0.000**
Mouginis-Mark	U of Hawaii	0.000		0.000	**0.000**
Murakami	MRI, Japan		0.000		**0.000**
Pyle	U of Cambridge, England	0.030			**0.030**
Rothrock	U of Washington	0.000	0.001		**0.001**
Schimel	Ames Research Center			0.346	**0.346**
Schoeberl	GSFC	0.032			**0.032**
Sellers	U of Maryland	0.008		0.000	**0.008**
Srokosz	BNSC, England		0.000		**0.000**
Tapley	U of Texas-Austin	0.001			**0.001**
Wielicki	LaRC	6.000			**6.000**
TOTAL (GB/day)		**8.334**	**0.293**	**3.620**	**12.247**

* *Daily data rates were calculated, based on total volume estimates by IIs and assuming 5 years of research.*

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Appendix D. Instrument Manifest

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Table D-1: Instrument Manifest

Spacecraft	Launch Date	Instrument	Type	Investigator	Data Rate (Kbps)		Duty Cycle (%)		Non-Continuous	Operated from	Mass
					Average	Peak	Day	Night	Obs per Orbit**	GSFC/IFC	(kg)
COLOR	Jan-1998	Sea WIFS	FI	TBD	282.6	698.7	100	0	1	YES	25
AM-1	Jun-1998	ASTER	FI	Kahle	8300.0	89200.0	8/16	0/16	15	**NO**	450
		CERES	PI	Barkstrom	20.0	20.0	100	100	0	YES	90
		MISR	PI	Diner	3800.0	6500.0	100	0	1	**YES**	135
		MODIS	FI	Salomonson	6200.0	11000.0	100	0/100	0	YES	278
		MOPITT	PI	Drummond	6.0	6.0	100	100	0	YES	160
AERO	Jun-2000	Total			18326.0	106726.0					1113
PM-1	Dec-2000	SAGE III	PI	McCormick	14.1	87.0	100	100	0	YES	35
		AIRS	FI	Chahine	1420.0	1420.0	100	100	0	**YES**	114
		AMSU-A	FI	Chahine	3.2	3.2	100	100	0	**YES**	100
		CERES	PI	Barkstrom	20.0	20.0	100	100	0	YES	90
		MIIS	FI	Chahine	4.2	4.2	100	100	0	**YES**	60
		MIMR	FI	Spencer*	67.0	67.0	100	100	0	YES	200
		MODIS	FI	Salomonson	6200.0	11000.0	100	0/100	0	YES	278
		Total			7714.4	12514.4					842
ALT	Jun-2002	ALT	FI	Fu	85.0	85.0	100	100	0	YES	275
		GGI	PI	Melbourne	50.0	50.0	100	100	0	**YES**	60
		GLRS-A	FI	Schultz	400.0	800.0	50	50	5	YES	350
		Total			535.0	935.0					685
CHEM	Jun-2002	HIRDLS	PI	Barnett/Gille	40.0	40.0	100	100	0	YES	150
		TES	PI	Beer	406.0	15617.0	100	100	RARE	**YES**	333
		SAGE III	PI	McCormick	14.1	87.0	100	100	0	YES	35
		STIKSCAT	PI	Freilich	5.2	5.2	100	100	0	**YES**	297
		Total			465.3	15749.2					815

*U.S. Team Leader

**A noncontinuous observation is one that is not routine according to orbital pattern location.

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Appendix E. Non-Eos Data Requirements Summary

Appendix E is provided for information purposes; it is not intended to be complete, but represents the best understanding to date.

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Table E-1 Non-EOS Data Requirements Listed by Data Product

DATA PRODUCT	SPACECRAFT	TYPE	TIMEFRAME	DATA SOURCE
ACE experiment data	In situ	Correlative	Pre launch	TBD
AIR data	In situ	Correlative	Pre launch	TBD
Airborne laser-induced Chlorophyll Phycoerythrin & DOM fluorescence	In situ	Correlative	Pre launch	TBD
Airborne radiances-0.41 to 0.75 um (aircraft)	In situ	Correlative	Post launch	TBD
Airborne SAR	In situ	Correlative	Pre launch	JPL
Airborne water-leaving radiances	In situ	Correlative	Pre launch	TBD
Aircraft AIS measurements	In situ	Correlative	Pre launch	TBD
Aircraft FLI measurements	In situ	Correlative	Pre launch	TBD
Aircraft laser altimetry	In situ	Correlative	Pre launch	TBD
Aircraft measurements (e.g., HIS COMEX data)	In situ	Correlative	Pre launch	TBD
Aircraft measurements (MISR simulation)	In situ	Correlative	Pre launch	TBD
Aircraft measurements of cloud liquid/ice content	In situ	Correlative	Post launch	TBD
Aircraft measurements of cloud optical thickness	In situ	Correlative	Post launch	TBD
Aircraft observation	In situ	Correlative	Pre launch	UWI
ALPEX data	In situ	Correlative	Pre launch	TBD
AMEX	In situ	Correlative	Pre launch	TBD
AMRIR data	NOAA	Ancillary	Post launch	NESDIS
AOL fluorescence (aircraft)	In situ	Correlative	Post launch	TBD
ASAS (aircraft)	In situ	Correlative	Pre launch	TBD
Atmospheric chemistry	AEM-2	Correlative	Pre launch	NSSDC
Atmospheric CO concentrations	In situ	Correlative	Pre launch	TBD
AVHRR digital elevation model	NOAA	Ancillary	Pre/post launch	NESDIS
AVHRR-HRPT	NOAA	Correlative	Pre launch	NESDIS
AVIRIS data	In situ	Correlative	Pre launch	PLDS
Backscatteimg coefficient (ERS-1 SAR)	ERS-1	Correlative	Pre launch	ESA
Backscattering coefficient (ship)	In situ	Correlative	Pre launch	TBD
Backscattering coefficient (JERS-1 SAR)	JERS-1	Correlative	Pre launch	NASDA (Japan)
Backscattering coefficient (JPL Airborne SAR)	In situ	Correlative	Pre launch	JPL
Backscattering coefficient (SIR-B SAR)	Shuttle	Correlative	Pre launch	NASA

Table E-1 Non-EOS Data Requirements Listed by Data Product (cont'd)

DATA PRODUCT	SPACECRAFT	TYPE	TIMEFRAME	DATA SOURCE
Backscattering coefficient (SIR-C SAR)	Shuttle	Correlative	Pre launch	NASA
Balloon nadir high res. spectra	In situ	Correlative	Pre launch	TBD
Buoy data (Artic)	In situ	Correlative	Pre launch	TBD
Buoy Data - wind speed, SST	In situ	Correlative	Pre launch	NOAA DBC
Climatology (T, H, P)	In situ	Correlative	Pre/post launch	ECMWF
Climatology station records	In situ	Correlative	Pre/post launch	NCDC
Cloud data	GOES	Correlative	Pre launch	NESDIS
Cloud motion winds	GMS/GOES	Ancillary	Pre launch	GISS
Clouds	NOAA	Ancillary	Post launch	NESDIS
COARE data (TOGA)	In situ	Correlative	Pre launch	ECMWF
COHMEX field data	In situ	Correlative	Pre launch	UWI,UWA
Corner reflectors geographic locations	In situ	Correlative	Pre launch	IERS
CZCS data	NIMBUS-7	Correlative	Pre launch	NSSDC
Detritus absorption coefficient (ship)	In situ	Correlative	Post launch	TBD
Diffus. atten. coeff.-downwelling rad. (ship/buoy)	In situ	Correlative	Post launch	TBD
Diffus. atten. coeff.-upwelling radiation (ship/buoy)	In situ	Correlative	Post launch	TBD
Digital radar reflectivities	In situ	Correlative	Pre launch	NCDC, NWS
Downwelling spectral radiance (ship/buoy)	In situ	Correlative	Post launch	TBD
Earth Radiation budget	NOAA	Correlative	Pre launch	NSSDC
EGCM-Eddy General Circulation Model	In situ	Correlative	Pre launch	TBD
EMEX data	In situ	Correlative	Pre launch	TBD
ERS-1 data (instrument not specified)	ERS-1	Correlative	Pre launch	ESA
FASINEX experiment data	In situ	Correlative	Pre launch	TBD
FGGE data	In situ	Correlative	Pre launch	NMC
FIFE data	In situ	Correlative	Pre launch	PLDS
Fluorescence line magnitude @685 um (ship)	In situ	Correlative	Post launch	TBD
Galileo data	Galileo	Correlative	Pre launch	NSSDC, JPL
Geodetic data	In situ	Correlative	Pre launch	USGS
Geopotential height analysis	In situ	Correlative	Pre launch	NMC,ECMWF
GEWEX data	In situ	Correlative	Pre launch	TBD
GLA-assimilated data	In situ	Correlative	Pre launch	NMC
Glaciological data (elevation)	In situ	Correlative	Pre launch	NSF/DPP
GLOBE backscatter	In situ	Correlative	Pre launch	TBD
GMS radiances.	GMS	Ancillary	Pre/post launch	NASDA (Japan)
GOES radiances	GOES	Ancillary	Pre/post launch	NESDIS

Table E-1 Non-EOS Data Requirements Listed by Data Product (cont'd)

DATA PRODUCT	SPACECRAFT	TYPE	TIMEFRAME	DATA SOURCE
GOES VAS data	GOES	Ancillary	Pre/post launch	NESDIS
Ground/AC LIDAR data	In situ	Correlative	Pre launch	MSFC
GWE maps	In situ	Correlative	Pre launch	TBD
HAPEX data	In situ	Correlative	Pre launch	TBD
HIRS/2 Level 1B radiance	NOAA	Ancillary	Pre launch	NESDIS
Humic and fulvic acids (ship)	In situ	Correlative	Post launch	TBD
Humidity data	DMSP	Ancillary	Pre launch	NODS
Hydrological data	In situ	Correlative	Pre launch	UNESCO,Army
Ice motion	ERS-1	Correlative	Pre launch	ESA
Ice sheet topography	In situ	Correlative	Pre launch	TBD
In-situ chlorophyll conc.(mid-Atlantic Blight)	In situ	Correlative	Post launch	TBD
In-situ chlorophyll fluorescence(mid-Atlantic Blight)	In situ	Correlative	Post launch	TBD
In-situ radiance measurements	In situ	Correlative	Pre/post launch	TBD
Incident spectral irradiance (ship/buoy)	In situ	Correlative	Post launch	TBD
ISCCP cloud data	GMS/GOES	Correlative	Pre launch	GISS,NCDS
ISCCP/FIRE data	In situ	Correlative	Pre launch	NCDS
JERS-1 data	JERS-1	Correlative	Pre launch	NASDA (Japan)
JGOFS (Joint Global Ocean Flux Study) data	In situ	Correlative	Pre launch	TBD
LAI	In situ	Correlative	Pre launch	TBD
Land surface temperature	In situ	Correlative	Pre launch	TBD
Landsat TM & MSS data	LANDSAT	Correlative	Pre launch	EDC, EOSAT
Latent heating profile	TRMM	Ancillary	Pre/post launch	NSSDC
Level 1-B radiances - AVHRR (GAC)	NOAA	Ancillary	Pre launch	NESDIS
LIMS data	NIMBUS-7	Correlative	Pre launch	NSSDC
MASEX experiment data	In situ	Correlative	Pre launch	TBD
Meteosat data	METEOSAT	Correlative	Pre launch	ESA
MIZEX experiment data	In situ	Correlative	Pre launch	TBD
Model outputs/analysis	In situ	Correlative	Pre launch	NMC,ECMWF
Moisture analysis	In situ	Correlative	Pre/post launch	NMC,ECMWF
MOS data	MOS-1	Correlative	Pre launch	NASDA (Japan)
MSU Level 1B radiance	NOAA	Ancillary	Pre launch	NESDIS
NASA Aircraft scanner (NS-001) measurements	In situ	Correlative	Pre launch	NASA
NASA AOL EXP. data	In situ	Correlative	Pre/post launch	NASA
NMC analysis fields (temperature and moisture profiles)	In situ	Correlative	Pre launch	NMC
NO2	In situ	Correlative	Pre launch	TBD

Table E-1 Non-EOS Data Requirements Listed by Data Product (cont'd)

DATA PRODUCT	SPACECRAFT	TYPE	TIMEFRAME	DATA SOURCE
Nutrient data base	In situ	Correlative	Pre launch	NODC
Ocean color	TBD	Correlative	Pre/post launch	NSSDC
Ocean salinity	In situ	Correlative	Pre launch	TBD
Ocean surface wind data	ADEOS	Ancillary	Pre launch	JPL
Ocean surface wind data	ERS-1	Ancillary	Pre launch	ESA
Particle absorption coeffient (ship)	In situ	Correlative	Post launch	TBD
Passive radar	In situ	Correlative	Pre launch	TBD
Phycobilipigments (ship)	In situ	Correlative	Post launch	TBD
Phyt. Pigment-chlor. a and phaeopigment a (ship)	In situ	Correlative	Post launch	TBD
Phytoplankton pigment (ship)	In situ	Correlative	Post launch	TBD
Polar motion data base	In situ	Correlative	Pre launch	NMC
Position data	GPS	Ancillary	Pre/post launch	TBD
PRARE down looking dual frequency radio data	In situ	Correlative	Pre launch	TBD
Precipitation	DMSP	Correlative	Pre/post launch	NODS
Precipitation	In situ	Correlative	Pre/post launch	NCDC
Precipitation data	TRMM	Correlative	Pre/post launch	NSSDC
Profile data	In situ	Correlative	Pre launch	NWS
Radar altimetry	ERS-1	Correlative	Pre launch	ESA
Radar altimetry	GEOSAT	Correlative	Pre launch	Navy
RADARSAT data	RADARSAT	Correlative	Pre launch	CCRS (Canada)
Radiosonde soundings (columnlar H2O vapor, air temp. profile, humidity)	In situ	Correlative	Pre/post launch	NCDC
Rawinsonde data	In situ	Correlative	Pre launch	NWS
Reflectance factor (AMRIR)	NOAA	Ancillary	Pre launch	NESDIS
Reflectance factor (TM)	SPOT	Correlative	Pre launch	CNES (France)
Rocketsonde ascents	In situ	Correlative	Pre launch	NCDC
SAM aerosol data	NIMBUS-7	Correlative	Pre launch	NSSDC
SASS-1	SEASAT	Correlative	Pre launch	NODS
SBUV data	NIMBUS-7	Correlative	Pre launch	NSSDC
Sea level data	ERS-1	Correlative	Pre/post launch	ESA
Sea level pressure analysis	In situ	Ancillary	Pre/post launch	NMC
Sea soundings	In situ	Correlative	Post launch	TBD
Sea-level data	TOPEX	Correlative	Pre launch	JPL
SEASAT data (instrument not specified)	SEASAT	Correlative	Pre launch	NODS
SEASAT SAR digital elevation model	SEASAT	Correlative	Pre launch	JPL
Ship measured detached coccolith concentration	In situ	Correlative	Post launch	TBD

Table E-1 Non-EOS Data Requirements Listed by Data Product (cont'd)

DATA PRODUCT	SPACECRAFT	TYPE	TIMEFRAME	DATA SOURCE
Ship measured inorganic suspended matter concentration	In situ	Correlative	Post launch	TBD
Ship measured IR surface brightness temperatures	In situ	Correlative	Post launch	TBD
Ship measured organic suspended matter concentration	In situ	Correlative	Post launch	TBD
Ship measured total suspended matter concentration	In situ	Correlative	Post launch	TBD
Ship reports	In situ	Correlative	Pre launch	NCDC, FNOC, CSIRO
Ship/buoy measured PAR (400 - 700 nm)	In situ	Correlative	Post launch	TBD
Ship/buoy measured primary productivity (14-C)	In situ	Correlative	Post launch	TBD
Shuttle laser altimetry	Shuttle	Correlative	Pre launch	JPL
Shuttle limb viewing	Shuttle	Correlative	Pre launch	JPL
Sky radiance data (SBRDF)	In situ	Correlative	Pre launch	TBD
SMMR data	NIMBUS-7	Correlative	Pre launch	NSSDC
Snow and ice data	DMSP	Correlative	Pre launch	NSIDC
Snow and ice extent	In situ	Correlative	Pre launch	TBD
Soil maps (7.5 min topo)	In situ	Correlative	Pre launch	USDA
Soil moisture transects	In situ	Correlative	Pre launch	TBD
Soil types	In situ	Correlative	Pre launch	TBD
Soil water capacity	In situ	Correlative	Pre launch	TBD
Solar acitvity (sunspot, flare)	In situ	Correlative	Pre launch	TBD
Solar irradiance	SMM	Correlative	Pre launch	NASA
Space shuttle data (instrument not specified)	SHUTTLE	Correlative	Pre launch	NASA
Spectral beam attenuation coefficient (ship/buoy)	In situ	Correlative	Post launch	TBD
Spectral reflectance factor (ship)	In situ	Correlative	Post launch	TBD
Spectral solar atmos. transmission (ship/station)	In situ	Correlative	Post launch	TBD
Spectrometer data	In situ	Correlative	Pre launch	TBD
SPOT data	SPOT	Correlative	Pre launch	CNES (France)
SPOT digital elevation model	SPOT	Correlative	Pre launch	CNES (France)
SST	NOAA	Ancillary	Pre/post launch	NESDIS
SSU Level 1B radiance	NOAA	Ancillary	Pre launch	NESDIS
STREX experiment data	In situ	Correlative	Pre launch	TBD
Surface features (instrument not specified)	ERS-1	Correlative	Pre/post launch	ESA
Surface flux	In situ	Correlative	Pre launch	TBD

Table E-1 Non-EOS Data Requirements Listed by Data Product (cont'd)

DATA PRODUCT	SPACECRAFT	TYPE	TIMEFRAME	DATA SOURCE
Surface wind	DMSP	Ancillary	Pre/post launch	NMC, IOSDL
SW/LW radiation	GOES	Correlative	Pre/post launch	Scripps Inst.
Temperature analysis	In situ	Correlative	Pre/post launch	NMC,ECMWF
THIR cloud data	NIMBUS-7	Correlative	Pre launch	NSSDC
Tide gauge sea level values	In situ	Correlative	Pre launch	IERS
TOGA data	In situ	Correlative	Pre launch	TBD
TOMS ozone data	NIMBUS-7	Ancillary	Pre launch	NSSDC
Total dissolved organic carbon (ship)	In situ	Correlative	Post launch	TBD
TOVS (HIRS/2, SSU, MSU) sounding data	NOAA	Ancillary	Pre launch	NESDIS
Tropical cyclone positions and intensities	In situ	Correlative	Pre launch	NHC/JTWC
UARS data (instrument not specified)	UARS	Correlative	Pre launch	NSSDC
UARS MLS data products	UARS	Correlative	Pre launch	NSSDC
University of Washington C-131 aircraft measurements	In situ	Correlative	Pre launch	UWA
Upwelling spectral radiances (ship/buoy)	In situ	Correlative	Post launch	TBD
Vegetation index - NDVI	NOAA	Correlative	Pre/post launch	NESDIS
VLBI data	In situ	Correlative	Pre launch	IERS
Water-leaving radiances (ship/buoy)	In situ	Correlative	Post launch	TBD
Weather forecasts (6hr,12hr,18hr,24hr)	In situ	Correlative	Pre/post launch	NMC,ECMWF
Wind Climatologies	In situ	Correlative	Pre launch	NOAA/WPL
WOCE data	In situ	Correlative	Pre launch	TBD

Table E-2 Non-EOS Data Requirements Listed by Investigator.

Investigator	Non-EOS data requirement	Source Noted by Investigator
ABBOTT, MARK	Analysis	At own facility
	Ocean color data pre-launch +	SeaWiFS + OCT
	in situ data binary as available	JGOFS
ADLER, ROBERT	SSM/I brightness tem DMSP Not time critical	By investigator
ADLER, ROBERT	Aircraft observations - not time critical	In-house (Code 612, GSFC)
	Sfc radar observations - not time critical	In-house (Code 612, GSFC)
	rain gage data	NOAA
ALISHOUSE, JOHN	NEXRAD weather radar	NOAA
ATLAS, ROBERT	Atmos. parameters - Not time critical	TBD
BAKER, WAYMAN	Cloud Wind Vectors GOES	NOAA/NESDIS
	NMC Level Z	NOAA/NMC
BARKSTROM, BRUCE	NMC data	NMC-NOAA
BARRON, ERIC	AVHRR retriev.params NOAA-?	NOAA
	SPOT topography	SPOT Corporation (France)
	in-situ T/RH profile	PSU/NOAA
	in-situ circulations	PSU/NOAA
	synoptic meteor.obs.	NOAA/NMC
BARTON, IAN	Ship/buoy obs	NOAA/National Climatic Center
BATES, JOHN	in-situ met.obs. daily	NOAA
	TRMM, others - daily	CDHF (DADS)/other archives
BEVIS, MICHAEL	GPS ranging data	as available
BREWER, PETER	SAR ocean wave data days	ocean basin wave observations
CARDER, KENDALL	H2O leaving radiance ADEOS	ADEOS project
	H2O leaving radiance SeaWiFS	SeaWiFS project
	in situ observations ships several/yr.	TBD
CARSEY, FRANK	Drifting buoy data - infrequently	NOAA Arctic and Antarctic drifting buoy network
	NMC surface analyses - infrequently	NOAA
	Sea ice extents NOAA twice per winter	JPL
CLARK, DENNIS	Bio-optical database	NOAA/NESDIS
	MOS Buoy data - as acquired	NOSS/NESDIS
	Ship observations - 1 field exp/yr	NOAA/NESDIS
DAVIS, CURTISS	in-situ observations continuing exp.	JPL/USN Post-graduate School, Monterey
DOZIER, JEFF	Digital Elev.Model standard	UC Santa Barbara
	Field observations	UC Santa Barbara + other groups in China+Europe
	SPOT stereo-images	SPOT data archive
DRUMMOND, JAMES	Winds NOAA	NOAA
EMMITT, GEORGE	GOES images standard same as SCANSCAT	NOAA
	Ground truth winds as available	NOAA
EVANS, ROBERT	SFC pressures	TBD
FLEMING, HENRY	AMSU A/B calib.rads.(NOAA)24 hours	NOAA
	met.soundings+surf. coincident with AIRS	NOAA

Table E-2 Non-EOS Data Requirements Listed by Investigator (cont'd)

Investigator	Non-EOS data requirement	Source Noted by Investigator
GAUTIER, CATHERINE	Meteorological Obs. bef./after overpass	NOAA/NMC
	in-situ ship obs. when available	NOAA/Scripps-std.obs +special inst.
GILLE, JOHN	base height weekly ?	NMC standard meteorological product
GORDON, HOWARD	Ozone conc.(GOMR) - as available	NOAA (or EosDIS if another sensor is used
GORDON, HOWARD	Surface air pressure	NOAA-meteorological data and modeling
GURNEY, ROBERT	GOES/METEOSAT/GMS	NOAA
	H2O runoff (g-truth)	NOAA (ADCLS)
HANSEN, JAMES	in-situ ocean data	GISS
HARRIS, GRAHAM	Ship SST	CISRO, Australia
HARTMANN, DENNIS	Fluxes from ERBI	NOAA/NESDIS
HOGE, FRANK	NASA AOL EXP. data	By investigator
ISACKS, BRYAN	AndesMIS	IST (Cornell University) and/or EosDIS
	digital elevations	IST (Cornell University) and/or EosDIS
	in-situ data	Cornell University (AndesMIS)
KASISCHKE, ERIC	Ground truth data coincident w/ SAR overpass.	ERIM-directed data acquisition.
KING, MICHAEL	Aircraft observation	University of Wisconsin
LANDGREBE, DAVID	field experiments	Purdue University experiments.
LEMARSHALL, JOHN	Ground truth exps As acquired	Aus.BoM field experiments
MCMILLIN, LARRY	Radiosonde data	NOAA
MELBOURNE, WILLIAM	ACRIM data standard	SMM Archives
MENZIES, ROBERT	NMC analysis prods. as acquired	NOAA
	Lidar-ground,air obs pre/post launch	field studies (JPL)
MILLER, TIMOTHY	Model outputs	NMC, ECMWF or GSFC (Global analyses)
MOORE, BERRIEN	AIS radiances plane	UNH ?
	AVHRR radiances NOAA-X	NOAA
	AVIRIS radiances	NOAA/UNH ?
	CO2 fluxes(air/sfc)	in-situ CO2 flux measurements
	DBM output - weekly	UNH
	FLI radiances	NOAA/UNH ?
	GLM assim.output monthly	UNH
	SPOT radiances	SPOT Corporation (France)
	TEM output - monthly (weekly-CO2)	UNH
	TGM output - weekly	UNH
MOUGINIS-MARK, PETER	GOMR data standard as acquired	NOAA (via EosDIS?)

Table E-2 Non-EOS Data Requirements Listed by Investigator (cont'd)

Investigator	Non-EOS data requirement	Source Noted by Investigator
MULLER, JAN-PETER	Agrophysical params.	EosDIS or University College London
	DEM's - yearly	EosDIS or University College London
	SAR radiances ERS-1 80 times/yr.	
	Spectral BDRFs	EosDIS (or University College London)
	Spectral signatures as available	EosDIS or University College London
	Surf.class(spectral) - yearly	EosDIS or University College London
	in situ observations several times/yr	University College London
NORTH, GERALD	In-situ data as acquired in field	JPL (collected form field studies)
PAEGLE, JAN	Surface pressures as available	operational P's-EOS(AIRS) or standard NOAA product
PYLE, JOHN	GOMR data NOAA	NOAA
RIZZI, ROLANDO	Meteorological data	ECMWF
ROWAN, LAWRENCE	In-situ mineral obs. 2/yr at 7 sites	USGS
SCHOEBERL, MARK	Pre-UARS retrievals	NOAA/NASA archives
	UARS-era retrievals	NOAA/NASA archives
SLATER, PHILIP	ER/2 obs.w/radioms. during field exps.	Univ.ofAriz. team.
	ER/2 overflight data - field exps 3/yr.	Univ. of Arizona
	Radiosonde data - during field exps.	NOAA + special obs.by Uof Ariz. team
	TM,AVHRR,AVIRIS,ETM 6 weeks after exp.	NOAA etc.-to comparewith EOS instrmnts over site
SMITH, WILLIAM	HIS-2 raw data - as acquired	Univ.of Wisc.
SPENCER, ROY	MSR data MOS-1	Japan
	SMMR brightness temperatures - binary	TBD
	SSM/I data DMSP	TBD
SROKOSZ, MERIC	Humidity data DMSP	NODS
	Ocean color SeaWiFS	TBD
	Precipitation DMSP	TBD
	SW/LW radiation GOES	C. Gautier at Scripps
	Sea level data ERS-1	TBD
	Sea surface temp. TIROS	Dundee & NOAA archive
	Surface features ERS-1	TBD
	Surface wind DMSP	IOSDL & UK EODC
STROW, L.	in-situ met.data same time as AIRS	NOAA
SUSSKIND, JOEL	in-situ met. data	NOAA
	GOMR O3 profiles NOAA	EosDIS or NOAA archives
TAPLEY, BYRON	IERS	TBD
	SLAR	TBD
VANDERBILT, VERN	MODIS pol.sim.data - ER/2 flights over various plant canopies -pre Eos	TBD
WATERS, JOE	Derived profiles-all standard	JPL
	Global maps of profs standard (UARS)	JPL
WENTZ, FRANK	Buoy data - Not time critical	NOAA Data Buoy Center, Bay St.Louis, MS
	Radiosonde soundings	Ashville
	Ship reports - Not time critical	FNOC, Montery, CA
WIELICKI, BRUCE	NMC data	NOAA

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Appendix F. Change Rationale

Appendix F provides both
a summary and detailed description
of the proposed change rationale

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System Sections 1. Through 5. Change Rationale Summary

- *Preface* -- The document preface was changed to include information summarizing the intent of the specification and how proposed changes are documented and summarized.

- *Free-Form Text* -- Numbered paragraphs containing descriptive free-form text is considered informational only. The wording in section 1.3 was changed to reflect this. Any sentences which contained the word "shall" were modified. For statements containing requirement information, a new numbered requirement was derived and placed in the system section. For other statements, the "shalls" were changed to "will." The detailed requirements rationale documents those requirements derived in this manner, and follows this summary.

- *Evolution and Expandability* -- The wording in section 1.4 was augmented to reflect the evolutionary nature of the ECS program and the need to prepare for evolving requirements. The contents of DID216 are expected to change through the years to meet the needs of the customer and the users. DID216 is not a static document after SRR. Pointers to the ECS Systems Engineering Plan and the ECS System Implementation plan were added. These documents contain the plan and procedures associated with the growth and evolution for ECS.

- *DAAC Definition* -- Numerous changes were made to the system sections (and segment sections) to correct the definition of a DAAC. The treatment of the term DAAC was inconsistent because it could refer to an "element" or a "site." Changes were made to the wording in sections 1.2, 4.1, 4.2, and 4.5 to correct the inconsistencies. The wording of the specification now defines DAACs to be sites where IMS, PGS and DADS functionality resides. PGS and DADS are considered elements of the SDPS, not sub-elements. These changes were necessary in order to match the changes made in the SDPS (section 7.0).

- *Applicable Documents* -- Some document references and standards are out of date.

- *FSTs* -- The description of the FST and its function was included under the definition of the SDPS. The FST is not part of the SDPS, and the paragraph was moved for that reason.

- *Network Interfaces* -- Wording and requirements modifications were made to clarify ESN interfaces to external systems and institutional resources. The ESN provides at path to the SN, DSN, WTS, and EDOS via Ecom. ESN does not provides all communications for ECS. PSCN provides the inter-site backbones and other GFP links provide communications between ESN and selected SCFs, ADCs, ISTs and IP Pickup Points. Changes were made to sections 4.1, 4.3.3, and 4.5. The detailed requirements rationale table documents requirements modified for this reason.

- *Project vs. Institutional Resources* -- EDOS and Ecom are project resources (since the change from the days of CDOS and Nascom II), not institutional. Sections 4.3.1 and 4.3.2 were slightly reorganized to reflect this change.

- *System Context Diagrams* -- The system context diagram, figure 4-2, was made consistent with other context diagrams within the specification. All context figures were checked for consistency and modified where needed.

- *Network Links and Data Rates* -- Section 4.3.3 was changed to reflect the changes made in the FOS (section 5.0). Channels and data rates were made consistent.

- *Operational View* -- Many wording changes were made to reflect the new operations concept for the FOS (including scheduling and DARs). For more information, a pointer to DID604, the ECS Operations Concept document, was added.

- *ECS SOW* -- The ECS SOW was scanned for functional and performance requirements. Those items, not already covered by an existing ECS requirement, were moved over as derived requirements. The detailed requirements rationale table documents requirements derived in this manner.

- *Testability* -- Numerous requirements modifications and deletions were made for those requirements that were untestable or non-verifiable. The detailed requirements rationale table documents requirements that were modified or deleted for these reasons.

- *V0* -- An extensive effort was undertaken to examine the existing V0 requirements. Those requirements were compared with existing ECS requirements. Where necessary, new requirements were added throughout the specification (system level and SDPS).

SYSTEM SECTION 5. REQUIREMENTS CHANGE DETAIL

Original Req. ID	New Req. ID	Rationale For Change
EOSD0010		MODIFIED – Original implied we I/F directly to the SN. Not via Ecom and EDOS.
EOSD0015		MODIFIED – Original implied we I/F directly to the DSN, GN, WTS as backup. Not via Ecom and EDOS.
EOSD1700		DELETED – It is a design level requirement. Not all service I/Fs must necessarily be routed through the IMS. Design limiting.
EOSD1010		MODIFIED – Original requirement addressed only input rates, and did not reference Appendix C. The derivable sizing involves much more than data rates and must be derived from Appendix C and D together.
EOSD1140		MODIFIED – 10% of the development resources can be allocated at the Sustaining Engineering Facility.
EOSD1680		MODIFIED – "EOS" spacecraft simulators.
EOSD1690		MODIFIED – "EOS" spacecraft simulators.
New	EOSD1506	NEW – Derived from the ECS SOW. From a "shall"-type statement. This requirement also serves as the parent for other new V0 requirements in the SDPS sections.
EOSD1606		DELETED – It is a design level requirement. Cannot verify capacity sizing for systems whose "development is not underway." Not necessary for the specification since it is covered by EOSD1607 and EOSD0545.
EOSD1607		MODIFIED – Cannot test / verify: "whose data systems are under development." What is under development changes with time. Limited EPDS support.
EOSD1760		MODIFIED – Added billing information access for the science community.
EOSD2100		MODIFIED – Cannot test / verify: "planning."
EOSD2400		MODIFIED – Testability issue. Added reference to appropriate security standards guide to define the boundries of performance, as indicated in free form text paragraph 5.5.
EOSD2430		MODIFIED – Took out design detail. Filtering is a method of control. Level 4 type requirement.
EOSD2480		DELETED – Design specific. Level-4 type requirement which addresses the issue of communications sessions for controlled data.
EOSD2510		MODIFIED – Virus protection cover sonly the ECS hosts. Worms address customer concern for network security.
EOSD2550		MODIFIED – Took out design detail. Master password protection is to be provided in general. Level 4 type requirement.

SYSTEM SECTION 5. REQUIREMENTS CHANGE DETAIL (continued)

EOSD2640		MODIFIED – Took out design limitation and made it "configurable."
EOSD2650		MODIFIED – Testability issue. ECS will report detected security violations.
EOSD3000		MODIFIED – Took out design information including use of O/S capabilities to provide security safeguards.
EOSD3220		MODIFIED – Testability issue. Cannot verity "with care."
New	EOSD3492	NEW – Derived from the ECS SOW. From a "shall"-type statement.
New	EOSD3495	NEW – Derived from "shall" statement included in the paragraph within section 5.6.1.
EOSD3510		MODIFIED – Corrected references regarding reliability predications. Requirements bounding and testability issue. A parts count prediction in accordance with Appendix A has the latest part inherent failure rate data.
EOSD3600		MODIFIED – Corrected references regarding maintainability. Requirements bounding and testability issue.
EOSD3610		MODIFIED – Corrected references regarding maintainability, MTBF to MTBM.

FOS Section 6.0 Change Rationale Summary

The changes made to the FOS section of the ECS Requirements Specification are based on the analysis performed by the FOS team on the Functional and Performance Requirements Specification, dated February 16, 1993. This includes incorporating the changes associated with the NASA ECS Technical Direction, dated 4/1/93. In the context of FOS, the primary changes to the requirements are based on the new spacecraft and instrument manifest for ECS, which is defined in Appendix D of the Functional and Performance Requirements Specification. This includes the five spacecraft that the FOS is responsible for mission operations, i.e., AM-1, AERO, PM-1, ALT, and CHEM, and their respective instruments.

EOC Element Summary

The primary changes to the EOC requirements are:

- *DARS* -- The DAR Processing Service has been moved from the EOC to the ICC. The reason for this change is that DARs are instrument-specific requests. Technical issues pertaining to a DAR can most effectively be resolved at the ICC associated with the DAR. The equivalent requirements pertaining to the DARs that were previously in the EOC requirements are now covered in the ICC requirements.

- *Simplified P&S Terminology* -- The Planning and Scheduling Service has simplified its terminology to reduce the number of acronyms and provide names that clearly define the state of the plan or schedule in the system. The Planning and Schedule Service reflects the current operational concept of long-term planning, initial scheduling, and final scheduling. Examples of the terminology changes:

OLD	NEW
CFS - Conflict Free Schedule	Detailed Activity Schedule
STOP - Short Term Operations Plan	Preliminary Resource Schedule
STIP - Short Term Instrument Plan	Instrument Resource Profile or Instrument Resource Deviation List
PCAR - Platform Core Activity Requests	Spacecraft Subsystem Resource Profile
IAS - Instrument Activity Schedule	Instrument Activity List or Instrument Activity Deviation List
ISAR	Request for Instrument Activity

- *Other Changes* -- Other changes in the EOC section are primarily clarifications in terminology or in the requirements. For example, previously, data base terms included Project Data Base, Spacecraft Data Base, and Instrument Data Base. This was simplified to the Spacecraft Data Base and Instrument Data Base.

ICC Element Summary

The three primary types of changes defined for the EOC section also pertain to the ICC section. In particular, processing DARs for inclusion in the FOS schedules and the status interface for DARs with the IMS are defined in the ICC requirements. The same Planning and Scheduling Services modifications made to the EOC are also included in the ICC. And, general terminology and requirements clarifications were also made in the ICC.

FOS SECTION 6. REQUIREMENTS CHANGE DETAIL

Original Req. ID	New Req. ID	Rationale For Change
FOS-0020		MODIFIED - minor clarifications
New	FOS--0060	NEW - requirement was moved from paragraph 6.2.2
New	FOS-0070	NEW - requirement was moved from paragraph 6.2.2
New	EOC-0005	NEW - requirement added to reference FOS element external interface ICDs
EOC-0040		MODIFIED - clarifications
EOC-1010		DELETED – Subsumed by ICC-1050. The DAR processing service was redistributed to the ICCs.
EOC-1020		DELETED – Subsumed by ICC-1060. The DAR processing service was redistributed to the ICCs.
EOC-1030		DELETED – Subsumed by ICC-1060. The DAR processing service was redistributed to the ICCs.
EOC-1040		DELETED – Subsumed by ICC-1070. The DAR processing service was redistributed to the ICCs.
EOC-1050	ICC-1042	MOVED – The DAR processing service was redistributed to the ICCs.
EOC-1051	ICC-1044	MOVED – The DAR processing service was redistributed to the ICCs.
EOC-1060	ICC-1115	MOVED – The DAR processing service was redistributed to the ICCs.
EOC-1070	ICC-1130	MOVED – The DAR processing service was redistributed to the ICCs.
EOC-1080	ICC-1082	MOVED – The DAR processing service was redistributed to the ICCs.
EOC-1110		DELETED – Subsumed by ICC-1050 and ICC-1080. The DAR processing service was redistributed to the ICCs.
EOC-1120		DELETED – Subsumed by ICC-1160 . The DAR processing service was redistributed to the ICCs.
EOC-1130		DELETED – Subsumed by ICC-1160. The DAR processing service was redistributed to the ICCs.
EOC-1140	ICC-1041	MOVED – The DAR processing service was redistributed to the ICCs.
EOC-1150		DELETED – Subsumed by ICC-1160. The DAR processing service was redistributed to the ICCs.
EOC-1160	EOC-2005	MOVED – Moved from EOC-1160; "DARs that" was changed to "a request for" to reflect current ops concept for direct downlink service
EOC-2010		MODIFIED – "and associated uncertainties" will be advantageous for predicting s/c and instrument measurement errors; "maneuver" improves clarity

EOC-2030		MODIFIED – a-h changes represent current ops concept for long-term planning, initial scheduling and final scheduling where: "Long-term spacecraft operations plan" represents a long-term plan of s/c subsystem operations and orbit maintenance (necessary for long-term planning); "Baseline activity profile" represents a baseline schedule of activities for normal operations of a non-complex instrument (necessary for initial and final scheduling); "Preliminary resource schedule" replaces "STOP" to represent an initial spacecraft and instrument schedule, derived from resource requirements, that includes the NCC TDRSS contact times (necessary for initial and final scheduling); "Detailed activity schedule" replaces "CFS" to represent the integrated, conflict-free schedule of activities for the instrument and spacecraft (necessary for final scheduling)
EOC-2045		MODIFIED – "a common set of capabilities" clarifies intent; "at the EOC" removed for clarity
EOC-2070		MODIFIED – all changes represent current ops concept for long-term planning where: "spacecraft subsystem resource profile" replaces "SCAR" to represent resource requirements for s/c subsystem and orbit maintenance needs over a target week (necessary for initial scheduling)
EOC-2080		DELETED – Subsumed by EOC-2070; PCARs no longer exist in current long-term planning ops concept
EOC-2150	ICC-2055	MOVED – Moved to ICC-2055; IMS notification for DARs is now function of ICC
EOC-2190		MODIFIED – "multiple" clarifies intent
EOC-2200		MODIFIED – "Thermal and power subsystems" is necessary for EOC verification of s/c health and safety; a-c listing improves clarity
EOC-3026	EOC-2205	MOVED – Moved from EOC-3026; reflects current ops concept for initial and final scheduling; moved to be near other resource requirements.
EOC-2250		MODIFIED – changes clarify intent and improve testability
EOC-2260		MODIFIED – "authorized users" included to reflect current ops concept for planning and scheduling

FOS SECTION 6. REQUIREMENTS CHANGE DETAIL (continued)

EOC-2270		MODIFIED – changes represent current ops concept for initial scheduling where: "instrument resource profile or instrument resource deviation list" replaces "STIP" to represent an instrument's resource needs, covering a target week, that is sent to the EOC for establishing TDRSS contact times (necessary for initial and final scheduling)
New	EOC-2272	NEW – requirement represents a necessary function for the current initial scheduling ops concept where: "baseline activity profile" represents a baseline schedule of activities for normal operations of a non-complex instrument (necessary for initial and final scheduling); "instrument resource deviation list" represents a list of instrument resource deviations from its baseline activity profile for a target week (necessary for initial scheduling); "instrument resource profile" represents the overall instrument resource needs for a target week, used by the EOC for establishing TDRSS contact times
EOC-2280		MODIFIED – changes represent current ops concept for initial scheduling where: "Preliminary resource schedule" replaces "STOP" to represent an initial spacecraft and instrument schedule, derived from resource requirements, that includes the NCC TDRSS contact times (necessary for initial and final scheduling)
EOC-2290		MODIFIED – changes represent current ops concept for initial scheduling where: "instrument resource profile" replaces "STIP" to represent an instrument's resource needs, covering a target week, that is sent to the EOC for establishing TDRSS contact times (necessary for initial and final scheduling); "Preliminary resource schedule" replaces "STOP" to represent an initial spacecraft and instrument schedule, derived from resource requirements, that includes the NCC TDRSS contact times (necessary for initial and final scheduling)

EOC-2300		MODIFIED – changes represent current ops concept for initial scheduling where: "Preliminary resource schedule" replaces "STOP" to represent an initial spacecraft and instrument schedule, derived from resource requirements, that includes the NCC TDRSS contact times (necessary for initial and final scheduling); "instrument resource profile" replaces "STIP" to represent an instrument's resource needs, covering a target week, that is sent to the EOC for establishing TDRSS contact times (necessary for initial and final scheduling); "spacecraft subsystem resource profile" represents resource requirements for s/c subsystem and orbit maintenance needs over a target week (necessary for initial scheduling)
EOC-2310		MODIFIED – "including SN resources" clarifies intent; changes represent current ops concept for initial scheduling where: "Preliminary resource schedule" replaces "STOP" to represent an initial spacecraft and instrument schedule, derived from resource requirements, that includes the NCC TDRSS contact times (necessary for initial and final scheduling); "spacecraft subsystem resource profile" replaces "PCAR" to represent resource requirements for s/c subsystem and orbit maintenance needs over a target week (necessary for initial scheduling); "instrument resource profile" replaces "STIP" to represent an instrument's resource needs, covering a target week, that is sent to the EOC for establishing TDRSS contact times (necessary for initial and final scheduling)
EOC-2320		MODIFIED – changes represent current ops concept for initial scheduling where: "Preliminary resource schedule" replaces "STOP" to represent an initial spacecraft and instrument schedule, derived from resource requirements, that includes the NCC TDRSS contact times (necessary for initial and final scheduling)
EOC-2350		MODIFIED – changes represent current ops concept for initial scheduling where: "Preliminary resource schedule" replaces "STOP" to represent an initial spacecraft and instrument schedule, derived from resource requirements, that includes the NCC TDRSS contact times (necessary for initial and final scheduling)

EOC-2370		MODIFIED – changes represent current ops concept for initial scheduling
EOC-2430		MODIFIED – changes clarify intent and improve testability; changes represent current ops concept for initial scheduling where: "Preliminary resource schedule" replaces "STOP" to represent an initial spacecraft and instrument schedule, derived from resource requirements, that includes the NCC TDRSS contact times (necessary for initial and final scheduling)
EOC-2460		MODIFIED – changes represent current ops concept for final scheduling where: "spacecraft subsystem activity list" replaces "core activity specification" to represent activities for s/c subsystem and orbit maintenance needs over a target week (necessary for final scheduling); "Detailed activity schedule" replaces "CFS" to represent the integrated, conflict-free schedule of activities for the instrument and spacecraft (necessary for final scheduling); "Preliminary resource schedule" replaces "STOP" to represent an initial spacecraft and instrument schedule, derived from resource requirements, that includes the NCC TDRSS contact times (necessary for initial and final scheduling)
EOC-2470		DELETED – subsumed by EOC-2460; information will be covered in level-IV requirements; "core activity specification" no longer exists in current final scheduling design
EOC-2480		MODIFIED – changes represent current ops concept for final scheduling where: "Instrument activity list or instrument activity deviation list" replaces "IAS" to represent an instrument's list of scheduled activities (necessary for final scheduling)
New	EOC-2482	NEW – requirement represents a necessary function for the current final scheduling ops concept where: "baseline activity profile" represents a baseline schedule of activities for normal operations of a non-complex instrument (necessary for initial and final scheduling); "instrument activity deviation list" represents a list of instrument activity deviations from its baseline activity profile (necessary for final scheduling); "instrument activity list" represents the overall instrument's list of scheduled activities (necessary for final scheduling)

EOC-2490		MODIFIED – changes represent current ops concept for final scheduling where: "Detailed activity schedule" replaces "CFS" to represent the integrated, conflict-free schedule of activities for the instrument and spacecraft (necessary for final scheduling)
EOC-2510		MODIFIED – changes represent current ops concept for final scheduling where: "Detailed activity schedule" replaces "CFS" to represent the integrated, conflict-free schedule of activities for the instrument and spacecraft (necessary for final scheduling); "spacecraft subsystem activity list" replaces "core activity specification" to represent activities for s/c subsystem and orbit maintenance needs over a target week (necessary for final scheduling); "Instrument activity list or instrument activity deviation list" replaces "IAS" to represent an instrument's list of scheduled activities (necessary for final scheduling)
EOC-2520		MODIFIED – "for the EOS spacecraft and instruments" removed because the meaning is apparent; changes represent current ops concept for final scheduling where: "Detailed activity schedule" replaces "CFS" to represent the integrated, conflict-free schedule of activities for the instrument and spacecraft (necessary for final scheduling)
EOC-2530		MODIFIED – "for the EOS spacecraft and instruments" removed because the meaning is apparent; changes represent current ops concept for final scheduling where: "Detailed activity schedule" replaces "CFS" to represent the integrated, conflict-free schedule of activities for the instrument and spacecraft (necessary for final scheduling)
EOC-2540		MODIFIED – changes represent current ops concept for final scheduling where: "Detailed activity schedule" replaces "CFS" to represent the integrated, conflict-free schedule of activities for the instrument and spacecraft (necessary for final scheduling); "IAS" replaced with "instrument activities"
EOC-2550		MODIFIED – changes represent current ops concept for final scheduling where: "Detailed activity schedule" replaces "CFS" to represent the integrated, conflict-free schedule of activities for the instrument and spacecraft (necessary for final scheduling)

EOC-2555		MODIFIED – "evaluate" improves requirement clarity; "critical instrument support activity" is no longer applicable in current planning and scheduling ops concept
EOC-2560		MODIFIED – "modify" improves requirement clarity; changes represent current ops concept for final scheduling where: "Detailed activity schedule" replaces "CFS" to represent the integrated, conflict-free schedule of activities for the instrument and spacecraft (necessary for final scheduling)
EOC-2570		MODIFIED – changes represent current ops concept for final scheduling where: "Detailed activity schedule" replaces "CFS" to represent the integrated, conflict-free schedule of activities for the instrument and spacecraft (necessary for final scheduling); "Instrument activity list or instrument activity deviation list" replaces "IAS" to represent an instrument's list of scheduled activities (necessary for final scheduling)
EOC-2580		DELETED – subsumed by EOC-2570; "critical instrument support activities" are subsumed by "late changes"
EOC-2590		MODIFIED – changes represent current ops concept for final scheduling where: "Detailed activity schedule" replaces "CFS" to represent the integrated, conflict-free schedule of activities for the instrument and spacecraft (necessary for final scheduling); "Instrument activity list or instrument activity deviation list" replaces "IAS" to represent an instrument's list of scheduled activities (necessary for final scheduling)
EOC-2600		DELETED – subsumed by EOC-2590; "critical instrument support activities" are subsumed by "late changes
EOC-2620		MODIFIED – changes represent current ops concept for final scheduling where: "Detailed activity schedule" replaces "CFS" to represent the integrated, conflict-free schedule of activities for the instrument and spacecraft (necessary for final scheduling)
EOC-2630		MODIFIED – changes clarify intent and improve testability; changes represent current ops concept for initial scheduling where: "Detailed activity schedule" replaces "CFS" to represent the integrated, conflict-free schedule of activities for the instrument and spacecraft (necessary for final scheduling)
EOC-3015		MODIFIED – For clarification and terminology changes

FOS SECTION 6. REQUIREMENTS CHANGE DETAIL (continued)

New	EOC-3017	NEW – Derived from Level 2 1552
EOC-3020		MODIFIED – For clarification and terminology changes
EOC-3024		MODIFIED – For clarification
EOC-3026		MOVED – to EOC-2205
EOC-3050		MODIFIED – For clarification and terminology changes
EOC-3070		MODIFIED – For clarification and terminology changes
EOC-3080		MODIFIED – For clarification
EOC-3085		MODIFIED – For clarification
EOC-3086		MODIFIED – For clarification
EOC-3090		MODIFIED – For clarification and terminology changes
EOC-3160		MODIFIED – For clarification of the types of reports to be generated
EOC-3200		MODIFIED – To clarify when preplanned commands can be used
EOC-3210		MODIFIED – For clarification
EOC-3225		MODIFIED – For terminology changes and to include late changes
EOC-3226		MODIFIED – For terminology changes and to include late changes
EOC-3235		DELETED – Subsumed by EOC-3225
EOC-3236		DELETED – Subsumed by EOC-3226
EOC-3238		MODIFIED – For clarification and terminology changes
EOC-3240		DELETED – Subsumed by EOC-3070
New	EOC-4005	NEW – Expansion of EOC-4010. Added to identify ground interface capabilities within EOC.
New	EOC-4008	NEW – Expansion of EOC-4010. Added to identify the Ecom network capability required for communication to the spacecraft.
EOC-4010		MODIFIED – Rewritten. Requirements EOC-4005 and EOC-4008 draw out specifics buried in the original requirement. The current requirement focuses on command uplink using the CCSDS Telecommand Standard.
EOC-4140		MODIFIED – Clarity.
EOC-4168		MODIFIED – Clarity.
EOC-4200		MODIFIED – To reflect the uplink rates required for SN and DSN support.
EOC-4210		MODIFIED – Terminology and clarity.
EOC-5010		MODIFIED – Terminology.
EOC-5012		MODIFIED – Terminology.
EOC-5015		MODIFIED – Clarity.

FOS SECTION 6. REQUIREMENTS CHANGE DETAIL (continued)

EOC-5020		MODIFIED – Clarity, this requirement is to process spacecraft telemetry data not launch vehicle telemetry data.
EOC-5030		MODIFIED – Clarification for testability.
EOC-5045		MODIFIED – Terminology.
EOC-5050		MODIFIED – Terminology and clarity.
EOC-5070		MODIFIED – Terminology and Clarity.
EOC-5090		MODIFIED – Clarity, the EOC processes housekeeping data, in order to protect health and safety.
EOC-5110		MODIFIED – Clarification for testability.
EOC-5130		MODIFIED – Terminology.
EOC-5185		MODIFIED – Clarity.
New	EOC-5187	NEW – Based on technical discussions.
EOC-5190		MODIFIED – Terminology.
EOC-5230		MODIFIED - Terminology.
EOC-5240		MODIFIED – Terminology.
EOC-6010		MODIFIED – For terminology change
EOC-6100		MODIFIED – Grammar correction
EOC-6110		MODIFIED - For clarification and terminology change
EOC-6120		DELETED – Subsumed by EOC-6110
EOC-6130	EOC-6135	SPLIT –To clarify when reconfigurations are recommended
EOC-6140		MODIFIED – For clarification
EOC-6150		MODIFIED – For clarification
EOC-6180		DELETED – Subsumed by EOC-8230, EOC-8240, and EOC-8250
EOC-6190		DELETED – Subsumed by EOC-6195, EOC-6200, and EOC-6210
EOC-6195		MODIFIED – For clarification
EOC-6200		MODIFIED – For clarification
EOC-7010		MODIFIED – For acronym definition and clarification
New	EOC-7015	NEW – Derived from Level 2 1557
EOC-7020		MODIFIED – For terminology change
EOC-7025		MODIFIED – For clarification and terminology change
EOC-7030		MODIFIED – For terminology change
EOC-7040		MODIFIED – For terminology change
EOC-7045		MODIFIED – For terminology change
EOC-7120		MODIFIED – For clarification and testability
EOC-7150		MODIFIED – For clarification
New	EOC-8005	NEW – General LSM interface requirement added to each element.
EOC-8010		MODIFIED – Clarity and Terminology.
EOC-8020		MODIFIED – Clarity.
EOC-8090		MODIFIED – Clarity.

EOC-8100		MODIFIED – Clarity, type of operational readiness testing to occur.
EOC-8130		MODIFIED – Clarity.
EOC-8150		MODIFIED – Clarify performance monitoring capability. DARs handled by the ICC.
EOC-8230		MODIFIED – Clarity.
EOC-8250		MODIFIED – Clarity.
EOC-8285		MODIFIED – Terminology.
EOC-8330		MODIFIED – Terminology and Clarity.
EOC-8375		MODIFIED – Clarity, DAR processing handled by the ICC.
EOC-9010		MODIFIED – For clarification and testability.
EOC-9020		MODIFIED – For clarification and terminology changes.
NEW	EOC-9025	NEW – Originally reflected only in the IST user interface sections, but also needed to be included in the EOC.
EOC-9130		MODIFIED – To remove ambiguity and improve testability.
EOC-9510		MODIFIED - clarification and add reference to additional spacecraft and instruments per Change Order #1
New	ICC-0005	NEW - requirement added to reference FOS element external interface ICDs
EOC-1050	ICC-1042	MOVED – The DAR processing service was redistributed to the ICCs.
EOC-1051	ICC-1044	MOVED – The DAR processing service was redistributed to the ICCs.
ICC-1050		MODIFIED – The DAR processing service will get inputs from the IMS.
ICC-1060		MODIFIED – For clarification.
ICC-1080		MODIFIED – The DAR processing service was redistributed to the ICCs and for clarification.
EOC-1080	ICC-1082	MOVED – The DAR processing service was redistributed to the ICCs.
ICC-1110		MODIFIED – The DAR processing service will get inputs from the IMS.
EOC-1060	ICC-1115	MOVED – The DAR processing service was redistributed to the ICCs.
ICC-1130		MODIFIED – The DAR processing service will get inputs from the IMS.
ICC-1160		MODIFIED – The DAR processing service will get inputs from the IMS.
ICC-1170		MODIFIED – For clarification.
ICC-2015		MODIFIED – change clarifies intent and improves testability
ICC-2017		MODIFIED – "for the TL or instrument PI" was removed to generalize IST functionality
ICC-2020		MODIFIED – "PI/TL" improves readability

FOS SECTION 6. REQUIREMENTS CHANGE DETAIL (continued)

EOC-2150	ICC-2055	NEW – moved from EOC-2150 because ICC now handles DAR analysis/notification functions
ICC-2110		MODIFIED – "scheduling directives" clarify intent; "its plans and schedules" necessary for defining the overall level of inclusion
ICC-2115		MODIFIED – changes represent current ops concept for planning and scheduling where: "instrument maintenance activities" replaces "ISAR" to represent the maintenance activities for an instrument
ICC-2120		MODIFIED – changes represent current ops concept for planning and scheduling where: "requests for instrument support activities" replaces "ISAR" to represent an activity requests for an instrument
ICC-2130		MODIFIED – changes represent current ops concept for planning and scheduling where: "requests for instrument support activities" replaces "ISAR" to represent an activity requests for an instrument
ICC-2135		MODIFIED – changes represent current ops concept for planning and scheduling where: "requests for instrument support activities" replaces "ISAR" to represent an activity requests for an instrument
ICC-2140		MODIFIED – changes represent current ops concept for initial scheduling where: "instrument resource profile or instrument resource deviation list" replaces "STIP" to represent an instrument's resource needs, covering a target week, that is sent to the EOC for establishing TDRSS contact times (necessary for initial and final scheduling)
ICC-2150		MODIFIED – changes represent current ops concept for initial scheduling where: "instrument resource profile or instrument resource deviation list" replaces "STIP" to represent an instrument's resource needs, covering a target week, that is sent to the EOC for establishing TDRSS contact times (necessary for initial and final scheduling)
ICC-2170		MODIFIED – "PI/TL" improves readability; changes represent current ops concept for initial scheduling where: "instrument resource profile or instrument resource deviation list" replaces "STIP" to represent an instrument's resource needs, covering a target week, that is sent to the EOC for establishing TDRSS contact times (necessary for initial and final scheduling)

ICC-2180		MODIFIED – changes clarify intent; changes represent current ops concept for initial scheduling where: "instrument resource profile or instrument resource deviation list" replaces "STIP" to represent an instrument's resource needs, covering a target week, that is sent to the EOC for establishing TDRSS contact times (necessary for initial and final scheduling)
ICC-2190		MODIFIED – changes represent current ops concept for initial scheduling where: "instrument resource profile or instrument resource deviation list" replaces "STIP" to represent an instrument's resource needs, covering a target week, that is sent to the EOC for establishing TDRSS contact times (necessary for initial and final scheduling); "instrument support activities" replaces "ISAR" to represent maintenance activity requests for an instrument; "Preliminary resource schedule" replaces "STOP" to represent an initial spacecraft and instrument schedule, derived from resource requirements, that includes the NCC TDRSS contact times (necessary for initial and final scheduling)
ICC-2210		MODIFIED – changes clarify intent; changes represent current ops concept for initial scheduling where: "instrument resource profile or instrument resource deviation list" replaces "STIP" to represent an instrument's resource needs, covering a target week, that is sent to the EOC for establishing TDRSS contact times (necessary for initial and final scheduling)
ICC-2220		MODIFIED – changes represent current ops concept for initial scheduling where: "instrument resource profile" replaces "STIP" to represent an instrument's resource needs, covering a target week, that is sent to the EOC for establishing TDRSS contact times (necessary for initial and final scheduling); details removed will be in level 4 requirements
ICC-2230		MODIFIED – "When generated" moved to improve readability; changes represent current ops concept for initial scheduling where: "instrument resource profile" replaces "STIP" to represent an instrument's resource needs, covering a target week, that is sent to the EOC for establishing TDRSS contact times (necessary for initial and final scheduling)

FOS SECTION 6. REQUIREMENTS CHANGE DETAIL (continued)

ICC-2250		MODIFIED – changes represent current ops concept for initial scheduling where: "Preliminary resource schedule" replaces "STOP" to represent an initial spacecraft and instrument schedule, derived from resource requirements, that includes the NCC TDRSS contact times (necessary for initial and final scheduling)
ICC-2260		DELETED – subsumed by ICC-2020
ICC-2270		MODIFIED – changes represent current ops concept for final scheduling where: "Instrument activity list or instrument activity deviation list" replaces "IAS" to represent an instrument's list of scheduled activities (necessary for final scheduling)
ICC-2280		MODIFIED – changes represent current ops concept for final scheduling where: "Instrument activity list or instrument activity deviation list" replaces "IAS" to represent an instrument's list of scheduled activities (necessary for final scheduling); "instrument support activities" replaces "ISAR" to represent maintenance activity requests for an instrument; "Preliminary resource schedule" replaces "STOP" to represent an initial spacecraft and instrument schedule, derived from resource requirements, that includes the NCC TDRSS contact times (necessary for initial and final scheduling)
ICC-2290		MODIFIED – changes clarify intent; changes represent current ops concept for final scheduling where: "Instrument activity list or instrument activity deviation list" replaces "IAS" to represent an instrument's list of scheduled activities (necessary for final scheduling)
ICC-2300		MODIFIED – changes clarify intent; changes represent current ops concept for final scheduling where: "IAS" no longer applies
ICC-2320		MODIFIED – changes clarify intent; changes represent current ops concept for final scheduling where: "IAS" no longer applies
ICC-2340		DELETED – notification is unnecessary because EOC DAR functions now handled by ICC
ICC-2350		MODIFIED – changes clarify intent; changes represent current ops concept for final scheduling where: "Instrument activity list or instrument activity deviation list" replaces "IAS" to represent an instrument's list of scheduled activities (necessary for final scheduling)

FOS SECTION 6. REQUIREMENTS CHANGE DETAIL (continued)

ICC-2360		DELETED – subsumed by EOC-2350; "critical instrument support activities" are subsumed by "late changes
ICC-2370		MODIFIED – changes clarify intent; changes represent current ops concept for final scheduling where: "Instrument activity list or instrument activity deviation list" replaces "IAS" to represent an instrument's list of scheduled activities (necessary for final scheduling)
ICC-2380		MODIFIED – changes represent current ops concept for final scheduling where: "Instrument activity list" replaces "IAS" to represent an instrument's list of scheduled activities (necessary for final scheduling); "requests for instrument support activities" replaces "ISAR" to represent an activity requests for an instrument
ICC-2390		MODIFIED – changes represent current ops concept for final scheduling where: "Instrument activity list or instrument activity deviation list" replaces "IAS" to represent an instrument's list of scheduled activities (necessary for final scheduling)
ICC-2400		MODIFIED – changes represent current ops concept for final scheduling where: "Instrument activity list or instrument activity deviation list" replaces "IAS" to represent an instrument's list of scheduled activities (necessary for final scheduling)
ICC-2410		MODIFIED – changes improve clarity; changes represent current ops concept for final scheduling where: "Instrument activity list or instrument activity deviation list" replaces "IAS" to represent an instrument's list of scheduled activities (necessary for final scheduling)
ICC-2420		MODIFIED – "approved" improves clarity; changes represent current ops concept for final scheduling where: "Instrument activity list or instrument activity deviation list" replaces "IAS" to represent an instrument's list of scheduled activities (necessary for final scheduling)
ICC-2430		MODIFIED – changes represent current ops concept for final scheduling where: "Instrument activity list or instrument activity deviation list" replaces "IAS" to represent an instrument's list of scheduled activities (necessary for final scheduling)

ICC-2450		MODIFIED – changes represent current ops concept for final scheduling where: "Instrument activity list or instrument activity deviation list" replaces "IAS" to represent an instrument's list of scheduled activities (necessary for final scheduling)
ICC-3010		MODIFIED - for terminology changes and to clarify exactly what is validated by the ICC
ICC-3020		MODIFIED - for terminology
ICC-3040		MODIFIED - for terminology changes and to be more specific
ICC-3060		MODIFIED - For clarification
ICC-3070		MODIFIED - For clarification
ICC-3071		MODIFIED - terminology changes clarification
ICC-3084		DELETED - Subsumed by ICC-3070
ICC-3085		MODIFIED - Terminology clarification
ICC-3110		MODIFIED - for clarification
ICC-3150		MODIFIED - For clarification.
ICC-3160		MODIFIED - for terminology changes and to be more precise
ICC-3210		MODIFIED – Clarity and Terminology. The current concept is that the EOC will verify resource usage independently.
ICC-3220		MODIFIED – Terminology.
ICC-3230		MODIFIED – Clarity.
ICC-3240		MODIFIED – Clarity.
ICC-3250		MODIFIED – Clarity and Terminology.
ICC-3262		MODIFIED – Clarity, include "late changes".
ICC-3266		DELETED – Subsumed by ICC-3262.
ICC-3400		MODIFIED – Clarity.
ICC-4010		MODIFIED – Clarify.
ICC-4040		MODIFIED – Terminology.
ICC-4060		MODIFIED – Terminology.
ICC-4070		MODIFIED – Clarify.
ICC-4090		MODIFIED – Clarity.
ICC-4095		MODIFIED – Clarification and testability.
ICC-4150		MODIFIED – Clarification and testability.
ICC-4160		MODIFIED – Terminology.
ICC-4180		MODIFIED – Terminology.
ICC-4190		MODIFIED – Terminology.
ICC-4220		MODIFIED – Clarity.
ICC-4230		MODIFIED – Terminology.
ICC-4410		MODIFIED - for terminology changes
ICC-4470		MODIFIED - for terminology changes and to be more specific
ICC-4540		SPLIT - split into ICC-4545
New	ICC-4545	SPLIT - split from ICC-4540 to separate different requirements
ICC-4560		MODIFIED - For testability

FOS SECTION 6. REQUIREMENTS CHANGE DETAIL (continued)

ICC-4590		MODIFIED - For clarification.
ICC-4600		MODIFIED - for terminology changes
ICC-4610		MODIFIED - for terminology changes
ICC-4710		MODIFIED - for terminology changes
ICC-4765		MODIFIED - for terminology changes
New	ICC-4775	NEW - Analog to EOC-7015
New	ICC-6000	NEW –General LSM interface requirement added to each element.
ICC-6005		MODIFIED – Clarity.
ICC-6010		MODIFIED – Clarity.
ICC-6020		MODIFIED – Clarity.
ICC-6030		MODIFIED – Clarity type of operational readiness testing to occur.
ICC-6060		MODIFIED – Clarify.
ICC-6080		MODIFIED – Terminology and Clarity.
ICC-6120		MODIFIED – Clarity.
ICC-6135		MODIFIED – Clarity.
ICC-6195		MODIFIED – Terminology and Clarity.
ICC-6510		MODIFIED – For clarification.
ICC-6520		MODIFIED – For clarification and terminology changes.
New	ICC-6525	NEW – Originally reflected only in the IST user interface section, but also need to be included in the ICC.
ICC-6620		MODIFIED – To remove ambiguity and improve testability.
ICC-7060		MODIFIED – For clarification.
ICC-7070		MODIFIED – For clarification.
ICC-7110		MODIFIED – For clarification.
ICC-7150		MODIFIED – For clarification .
ICC-7190		MODIFIED – For clarification.
ICC-7210		MODIFIED – For clarification and terminology changes.
ICC-7212		DELETED – Subsumed by ICC-7210.
ICC-7214		MODIFIED – For clarification.
ICC-7220		MODIFIED – For clarification.
ICC-7230		MODIFIED – For clarification.
ICC-7250		MODIFIED – For clarification.
ICC-7290		MODIFIED – Because of terminology changes.
ICC-7330		MODIFIED – For clarification.
ICC-7350		MODIFIED – For clarification.
ICC-7400		MODIFIED – For clarification.
ICC-7410		DELETED – Subsumed by ICC-7400.
ICC-7460		MODIFIED – For clarification.
ICC-7550		MODIFIED – For clarification.
ICC-8050		MODIFIED – For minor clarification.

SDPS Section 7. Change Rationale Summary

The following is a list of the major changes in SDPS requirements between the NASA F&PR and the ECS Requirements Specification:

- *DAAC Sites Not Elements* -- All DAAC requirements as well as supporting text have been deleted. The term "DAAC" now refers, consistently, to a site, not an element. Selected DAAC requirements have been moved to the SDPS section. See detailed rationale table for those DAAC requirements moved to the SDPS-level for this reason. In general, the term "DAAC" was changed to "SDPS" except where DAAC referred to ECS sites. Appendix C was referenced as the final authority on the types of data received and generated by ECS. Other DAAC requirements were partially integrated with existing SDPS requirements.

- *Ten Percent Reserve* -- A note was added to SDPS0093 (10% reserve requirement) to describe basic assumptions in change modification #1.

- *Scheduling* -- Scheduling requirements within the range of DADS-1950 through DADS-2260 were moved to PGS-0010 through PGS-0100 to correspond with the system-level design concept that the PGS will be responsible for all SDPS scheduling. Due to this consolidation of scheduling requirements, certain DADS requirements were either redundant with or subsumed by PGS requirements. See the detailed rationale table for a discussion of those scheduling requirements which were deleted for those reasons. PGS-0070, which deals with the EDOS & Pacor interface, is a new requirement to correspond with the change to DADS-2060, which removed the scheduling from the "data driven" interface between the SDPS and EDOS for Level-0 ingest.

- *Level 0 Data Interface* -- Requirements regarding the Level-0 data interface between EDOS and ECS were moved from DADS (0130, 2780) to PGS (0435, 0436) to reflect the system-level design concept (ECS RFP) of Level-0 data being received directly on the appropriate PGS processing "string."

- *Testability & "e.g." Lists* -- Most "e.g." lists were deleted or were replaced with specific lists. This was done chiefly to eliminate or reduce testability concerns.

- *SMC / SDPS I/Fs* -- References to LSM, as an interface to SMC, were deleted, for consistency. The LSM is not an element, and is therefore not at the same level within the specification. The level-IV requirements and design will clarify this later.

- *Standard Products* -- Merged PGS-0460 into PGS-0500 as marginally different requirements.

- *QA Timeouts* -- Removed design specifics from PGS-1170 and PGS-1180 regarding QA timeouts, and the related requirement DADS-1170 was moved to PGS-1265.

- *Large & Complex Requirements* -- The extraordinarily complex PGS-1300 requirement was split into PGS-1300 and PGS-1301, and its last sentence, which is apparently a new requirement, was deleted.

- *Application Programming Interfaces (APIs)* -- Change Order #1 requiring the development of Application Programming Interfaces (APIs) was traced to the following PGS requirements: PGS-1400, PGS-1410; to the following DADS requirements: DADS3140, DADS3150, DADS3160; as well as to the following IMS requirement: IMS-1595. The cost impact of these requirements has been documented in the Change Order #1 NTE.

- *Requirements Split* -- Several DADS F&PR requirements describe two or more ECS functional capabilities. These requirements were split into individual requirements.

- *Redundant Requirements* -- Redundant requirements were deleted. Some F&PR requirements are deleted in the DADS ECS specification because they are already covered in the CSMS ECS specification.

- *Derived Requirements From SOW, Spec. Text and V0* -- New requirements were derived from Level 2 requirements and Version 0 requirements. These new requirements address the archival of data from the Landsat-7, TRMM and Version 0 facilities. New requirements were also derived from the specification's free-form text. For a complete list of requirements derived from these sources, see the detailed rationale tables that follow.

- *Level IV Requirements & Design Detail* -- Level 4 ("design" level detail) portions of original requirements were deleted and will be included in the Level 4 specification. See the detailed rationale tables for a list of those requirements deleted and/or modified for this reason.

- *Requirements Reallocations* -- Some requirements were reallocated between the elements (all, not just SDPS elements). See the detailed rationale tables for a list of those requirements moved for this reason.

- *Modified Requirements* -- Many requirements were modified due to the following reasons: to clarify interface requirements, to clarify scope and functionality, and to make wording and typographical changes. The requirements, modified for these reasons, are listed in the detailed rationale tables that follow.

SDPS SECTION 7. REQUIREMENTS CHANGE DETAIL

Original Req. ID	New Req. ID	Rationale For Change
DAAC0160	SDPS0015	MOVED to SDPS0015, replacing "DAAC" with "SDPS"
SDPS0020		MODIFIED – added other data types listed in DAAC0130; referenced Appendix C
SDPS0030		MODIFIED – referenced Appendix C.
DAAC0220	SDPS0031	MOVED to SDPS0031, replacing "DAAC" with "SDPS" and removing explict IMS reference
SDPS0080		MODIFIED – added other sites listed in DAAC0150
SDPS0090		MODIFIED – added "testing" per DAAC0320, which was deleted
DAAC0092	SDPS0091	MOVED to SDPS0091, replacing "DAAC" with "SDPS"
SDPS0093		MODIFIED – added note describing the operations concept for the 10%reserve as assumed in the response to change modification #1
DAAC0330	SDPS0115	MOVED to SDPS0115, replacing "DAAC" with "SDPS"
DAAC0120	SDPS0130	MOVED to SDPS0130
DAAC0250	SDPS0140	MOVED to SDPS0140, replacing "DAAC" with "SDPS"
DAAC0262	SDPS0150	MOVED to SDPS0150, replacing "DAAC" with "SDPS"
DAAC0264	SDPS0160	MOVED to SDPS0160, replacing "DAAC" with "SDPS"
DAAC0010		DELETED – subsumed in SDPS0020
DAAC0020		DELETED – subsumed in SDPS0010
DAAC0030		DELETED – subsumed in SDPS0020, SDPS0050, and SDPS0080
DAAC0040		DELETED – subsumed in SDPS0110
DAAC0060		DELETED – subsumed in SDPS0100
DAAC0070		DELETED – subsumed in SDPS0030 and SDPS0050
DAAC0072		DELETED – subsumed in SDPS0050 and SDPS0100
DAAC0080		DELETED – subsumed in SDPS0050
DAAC0100		DELETED – subsumed in SDPS0100
DAAC0110		DELETED – subsumed in SDPS0090
DAAC0130		DELETED – subsumed in SDPS0020
DAAC0150		DELETED – subsumed in SDPS0080
DAAC0260		DELETED – subsumed in SDPS0040
DAAC0270		DELETED – subsumed in SDPS0120
DAAC0300		DELETED – subsumed in SDPS0030 and SDPS0031
DAAC0310		DELETED – subsumed in SDPS0090
DAAC0320		DELETED – subsumed in SDPS0090

PGS ELEMENT REQUIREMENTS CHANGE DETAIL

Original Req. ID	New Req. ID	Rationale For Change
	PGS-0002	NEW – reference to external IRDs
DADS-1950	PGS-0005	MOVED – SDPS scheduling function
DADS-1960	PGS-0010	MOVED – SDPS scheduling function
DADS-1970	PGS-0015	MOVED – SDPS scheduling function
DADS-1980	PGS-0020	MOVED – SDPS scheduling function
DADS-2000	PGS-0030	MOVED – SDPS scheduling function
DADS-2010	PGS-0040	MOVED – SDPS scheduling function
DADS-2030	PGS-0050	MOVED – SDPS scheduling function; MODIFIED - added Pacor for TRMM interface
DADS-2040	PGS-0060	MOVED – SDPS scheduling function; MODIFIED - added Pacor for TRMM interface
	PGS-0070	NEW – derived from DADS-2060
DADS-2070	PGS-0080	MOVED – SDPS scheduling function; MODIFIED - added Pacor for TRMM interface
DADS-2120	PGS-0090	MOVED – SDPS scheduling function
DADS-2250	PGS-0100	MOVED – SDPS scheduling function
PGS-0140		MODIFIED – indicate that scheduling function is performed for the entire SDPS
PGS-0150		MODIFIED – change source of schedules and add Pacor interface for TRMM
PGS-0210		MODIFIED – remove ambiguity
PGS-0240		MODIFIED – reprocessing need not absolutely adhere to reprocessing plan
DADS-0910	PGS-0255	MOVED – SDPS scheduling function
DADS-0925	PGS-0256	MOVED – SDPS scheduling function
PGS-0260		MODIFIED – indicate that all "configuration baseline changes" are scheduled which might include"calibration data handling"
	PGS-0310	NEW - indicate data to be gathered for SMC monitoring of the system
PGS-0325		MODIFIED – remove implementation details
PGS-0330		MODIFIED – remove implementation details
PGS-0340		DELETED – SMC requirement
PGS-0350		DELETED – SMC requirement
PGS-0370		DELETED – LSM requirement
PGS-0380		DELETED – LSM requirement
PGS-0420		DELETED – SMC requirement
PGS-0430		DELETED – SMC requirement
DADS-0130	PGS-0435	MOVED – PGS interface; MODIFIED – remove ambiguity and add Pacor interface for TRMM
PGS-0460		DELETED – merged with PGS-0500
PGS-0500		MODIFIED – merge with PGS-0460
PGS-0560		MODIFIED – remove implementation details
PGS-0602		MODIFIED – remove ambiguity
PGS-0610		MODIFIED – remove ambiguity
PGS-0650		MODIFIED – remove ambiguity
PGS-0900		MODIFIED – clarification
PGS-0950		MODIFIED – remove implementation details
PGS-1015		MODIFIED – remove ambiguity
PGS-1020		MODIFIED – remove ambiguity
PGS-1025		MODIFIED – remove ambiguity
PGS-1050		MODIFIED - limit responsibility

PGS ELEMENT REQUIREMENTS CHANGE DETAIL

PGS-1170		MODIFIED -- remove implementation details
DADS-1170	PGS-1175	MOVED - SDPS scheduling function
PGS-1180		MODIFIED -- remove implementation details
PGS-1210		MODIFIED – remove ambiguity
PGS-1220		MODIFIED – limit responsibility and remove ambiguity
PGS-1250		MODIFIED -- remove extraneous functionality
PGS-1260		MODIFIED -- remove extraneous functionality
DADS-1270	PGS-1265	MOVED -- SDPS scheduling function
PGS-1315		MODIFIED - remove ambiguity
PGS-1300		SPLIT – for simplification; partially DELETED – sentence to "effectively utilize"; identified as completely new functional requirement
PGS-1300	PGS-1301	NEW -- split
DADS-2780	PGS-1305	MODIFIED – remove ambiguity

DADS ELEMENT REQUIREMENT CHANGE DETAIL

Original Req. ID	New Req. ID	Rationale For Change
	DADS0005	NEW – IRDs specify interface requirement detail for external interfaces to this element
DADS0010		MODIFIED – Generic Terminology
DADS0020		MODIFIED – Generic Terminology
DADS0030	DADS0010	DELETED – Covered by DADS0010
DADS0090	DADS2778	MOVED – Moved to performance section
DADS0100		MODIFIED – Scheduling moved to PGS
DADS0130	PGS-0435	MOVED – L0 moved to PGS
DADS0150		MODIFIED – Use ICC terminology
DADS0160		MODIFIED – Use EOC terminology
DADS0170		MODIFIED – Removed "EPDSs"
DADS0280	DADS0281, DADS2315	SPLIT/MOVED – Decomposed for testability. Distribution part of requirement moved to distribution section.
	DADS0281	SPLIT/MOVED – Decomposition of DADS0280
	DADS0282	MOVED – Moved from DADS2790
DADS0290		REWORDED – Clarified
DADS0300		REWORDED – Clarified
DADS0350		MODIFIED – Removed "Granule ID"
DADS0370		MODIFIED – correct terminology
	DADS0405	MOVED– Moved from DADS0630
	DADS0410	MOVED – Moved from DADS0670
	DADS0412	MOVED/MODIFIED – Moved from DADS0640
DADS0425		MODIFIED – Need to specify the standards
	DADS0435	MOVED – Moved from DADS3020
DADS0450		MODIFIED – "associated metadata"
	DADS0465	NEW – Version 0
	DADS0470	NEW – Landsat 7
	DADS0475	NEW – TRMM
DADS0485	DADS2276	MODIFIED/MOVED - Remove level 4 details. Move to the backup section
DADS0487		DELETED – As long as EDOS is a backup of level 0 and since any level 1A product is reversible to produce level 0, it is unnecessary to store both level 0 whenever level 1A is produced.
DADS0488		MODIFIED – L0 data received from PGS
DADS0495	DADS1450,	MOVED – Moved to general section.
	DADS0498	MOVED – Moved from DADS2080
	DADS0525	MOVED/MODIFIED – Moved from DADS0650. Generic terminology.
DADS0560	DADS0998, DADS0499, DADS0600	DELETED – Subsumed by 498, 499, 600
DADS0570		MODIFIED – Removed level 4 details.
	DADS0591	SPLIT – Decomposition of DADS0590
	DADS0592	SPLIT – Decomposition of DADS0590
		NEW – Decomposition of DADS0650

DADS ELEMENT REQUIREMENT CHANGE DETAIL (continued)

DADS0610	DADS0405, DADS0411; DADS2330	DELETED -- Subsumed by DADS0405, DADS0411, and DADS2330.
DADS0620	DADS0410	MOVED -- Moved to archive section
DADS0630	DADS0405	MOVED -- Moved to archive section
DADS0640	DADS0412	MOVED/MODIFIED -- Moved to archive section. Clarified.
DADS0650	DADS0525	MOVED -- Moved to receive orders/request section.
DADS0660		MODIFIED -- Changed "maintain" to "access"
DADS0670		DELETED -- Subsumed by DADS2770
DADS0680	DADS3135, DADS3090	DELETED -- Subsumed by DADS3135 and DADS3090.
DADS0700		MODIFIED -- Generic terminology
DADS0710	DADS1110	MOVED -- Moved to Send/Receive section
DADS0720	DADS1806	MOVED -- Moved to FSMS section
DADS0730		MODIFIED -- Generic terminology
DADS0740		MODIFIED -- Added clarification
DADS0760		MODIFIED -- Specified formats
DADS0770		MODIFIED -- Specified formats
DADS0800		MODIFIED -- Specified inputs
DADS0880		MODIFIED -- Generic terminology
DADS0890		MODIFIED -- Generic terminology
DADS0900	DADS0901	DELETED -- Subsumed by DADS0901
DADS0910	PGS-0255	MOVED -- Scheduling moved to PGS
DADS0925	PGS-0256	MOVED -- Scheduling moved to PGS
DADS0927		MODIFIED -- Removed. Generation function
DADS0940		MODIFIED -- Clarified
DADS1000		MODIFIED -- Removed level 4 details and parts covered in 1032
DADS1010		MODIFIED -- Replaced "PGS" with "requestor"
DADS1070		MODIFIED -- Changed terminology
	DADS1085	NEW -- Moved from DADS1490
DADS1090	DADS1795	MODIFIED/MOVED -- Removed implementation wording. Moved to FSMS section.
	DADS1110	MOVED -- Moved from DADS0710
	DADS1114	MOVED/MODIFIED-- Clarified Moved from DADS1270
DADS1120	DADS1800	MOVED -- Moved to FSMS section
DADS1140	DADS1805	MOVED -- Moved to FSMS section
DADS1150	DADS1160	DELETED -- Subsumed by DADS1160
DADS1160		MODIFIED -- Clarified
DADS1170	PGS-1265	MOVED -- QA tracking done by PGS
DADS1190		DELETE -- Subsumed by DADS2330
DADS1230		DELETED -- Design detail
DADS1250	DADS2380	DELETED -- Subsumed by 2380
DADS1260	DADS2380	DELETED -- Subsumed by 2380
DADS1270	DADS1114	MODIFIED/MOVED -- Moved to Data Logs section, and clarified.
DADS1280	SMC4315	DELETED -- Subsumed by SMC4315
DADS1300	SMC2105	DELETED -- Subsumed by SMC2105
DADS1310		MODIFIED -- Removed level 4 details

DADS ELEMENT REQUIREMENT CHANGE DETAIL (continued)

DADS1320		MODIFIED – Clarified
DADS1330		MODIFIED – Clarified
DADS1340	SMC3385	MODIFIED – Subsumed by SMC3385
DADS1350		MODIFIED – Need to define standards standards
	DADS1375	MOVED – Moved from DADS3010(2)
DADS1380	SMC6335	DELETED – Subsumed by SMC6335
DADS1390	SMC6335	DELETED – Subsumed by SMC6335
DADS1400		
	DADS1450	MOVED – Moved from DADS0495
DADS1460	DADS1310	DELETED – Subsumed by DADS1310
DADS1475	DADS1475, IMS-1510	MODIFIED/MOVED – Modified for clarity. Moved (e) to IMS-1510
DADS1480	DADS0901	DELETED – Subsumed by DADS0901
DADS1490	DADS1085	MOVED/MODIFIED – Removed implementation wording. Moved to Data Logs section.
DADS1500	SMC8705	DELETED – Subsumed by SMC8705
DADS1510		MODIFIED – Clarified and removed level 4 details
DADS1530		MODIFIED – Removed master file directory implementation terminology
DADS1540		MODIFIED – Removed master file directory implementation terminology
DADS1550		MODIFIED – Removed master file directory implementation terminology
DADS1590		DELETED – Subsumed by ESN-0180
DADS1610		MODIFIED – Clarified
DADS1640		MODIFIED – Clarified
DADS1780		DELETED – Level 4 requirement
	DADS1791	MOVED – Moved from DADS2940
	DADS1795	MOVED– Moved from DADS1090
	DADS1805	MOVED – Moved from DADS1140
	DADS1806	MOVED – Moved from DADS0720
DADS1810		MODIFIED – Need to specify standards.
DADS1830		DELETED – This level of detail should be left to design trade-off.
DADS1840		DELETED – This level of detail should be left to design trade-off.
DADS1850	SMC-2515	DELETED – Subsumed by SMC-2515
DADS1860	SMC-2510	DELETED – Subsumed by SMC-2510
DADS1950	PGS-0005	MOVED – Scheduling done by PGS
DADS1960	PGS-0010	MOVED – Scheduling done by PGS
DADS1970	PGS-0015	MOVED – Scheduling done by PGS
DADS1980	PGS-0020	MOVED – Scheduling done by PGS
DADS2000	PGS-0030	MOVED – Scheduling done by PGS
DADS2010	PGS-0040	MOVED – Scheduling done by PGS
DADS2020		MODIFIED – Added PGS-0150 data
DADS2030	PGS-0050	MOVED – Scheduling done by PGS
DADS2040	PGS-0060	MOVED – Scheduling done by PGS
DADS2050	DADS2020	DELETE D– Subsumed by DADS2020
DADS2060		MODIFIED – Clarified
DADS2070	PGS-0080	MOVED – Scheduling done by PGS

DADS ELEMENT REQUIREMENT CHANGE DETAIL (continued)

DADS2080	DADS0498	MOVED – Moved to receive/orders section
DADS2090	PGS-0160, PGS-0190	DELETED – Subsumed by PGS-0160 and PGS-0910
DADS2100	PGS-0160, PGS-0190	DELETED – Subsumed by PGS-0160 and PGS-0190
DADS2110	PGS-0325	MOVED – Scheduling done by PGS
DADS2120	PGS-0090	MOVED – Scheduling done by PGS
DADS2130	SMC-1305 SMC-1315	DELETED – Subsumed by SMC-1305 and SMC-1315
DADS2140	DADS0901	DELETED – Subsumed by DADS0901
DADS2150	SMC-1500	DELETED – Subsumed by SMC-1500
DADS2160		MODIFIED – Eliminate the term schedule
DADS2170		MODIFIED – Eliminate the term schedule
DADS2180		MODIFIED – Eliminate the term schedule
DADS2190		MODIFIED – Eliminate the term schedule
DADS2200		MODIFIED – Eliminate the term schedule
DADS2210	PGS-0140	MOVED – Scheduling done by PGS
DADS2220	PGS-0140	MOVED – Scheduling done by PGS
DADS2240	DADS0520	DELETED – Subsumed by by DADS0520
DADS2250	PGS-0100	MOVED – Scheduling done by PGS
DADS2260	PGS-0140	MOVED – Scheduling done by PGS
DADS2270		MODIFIED – Removed level 4 details
	DADS2276	MOVED/MODIFIED – Clarified. Moved from DADS0485
DADS2290	DADS2270	DELETED – Subsumed by DADS2270
	DADS2300	MOVED/MODIFIED – Clarified. Moved from DADS3030
DADS2305	DADS1451	DELETED – Subsumed by DADS1451
DADS2307		MODIFIED – Clarified
DADS2310	DADS0901	DELETED – Subsumed by DADS0901
	DADS2315	MOVED/SPLIT – Decomposition of DADS0280
DADS2330		MODIFIED – DADS does not receive L0 from EDOS
DADS2400	DADS0140, DADS2340	DELETED – Covered by 1DADS0140 and DADS2340
DADS2410		MODIFIED – Eliminate information covered by 560 and 1806
DADS2440		MODIFIED – Removed level 4 details
DADS2460		MODIFIED – Clarified
DADS2490		MODIFIED – Specified media
DADS2500	DADS2490	DELETED – Subsumed by DADS2490
DADS2510		MODIFIED – Clarified
DADS2530	DADS2490	DELETED – Subsumed by DADS2490
DADS2550	DADS2770	MOVED/MODIFIED – More appropriate section. Clarified
DADS2580		MODIFIED – Need to define standards
DADS2620	DADS2330	DELETED – Subsumed by DADS2330
DADS2630	DADS3115	MOVED – Moved tp performance section
DADS2640	DADS3120	MOVED – Moved to performance section
DADS2660	DADS3125	MOVED/MODIFIED – Moved to performance section. Clarified.

DADS ELEMENT REQUIREMENT CHANGE DETAIL (continued)

DADS2670	DADS3130	MODIFIED/MOVED – Moved to performance section.
DADS2675		MODIFIED – CSMS maintains log
	DADS2770	MOVED – Moved from DADS2550
	DADS2778	MOVED – Moved fromf DADS0090
DADS2780	PGS-1305	MOVED – EDOS level 0 received by PGS
DADS2790	DADS0282	MOVED/MODIFIED – Moved to receive data section. Clarified.
DADS2940	DADS1791	MOVED – Moved to FSMS
DADS2950	DADS0435	DELETED – Subsumed by DADS0435
DADS2990	EOSD3920	DELETED – Subsumed by EOSD3920
DADS3000		MODIFIED – Removed. Redundant information
DADS3010(1)	DADS301, DADS0425	MODIFIED – Deleted portion subsumed by DADS0425
DADS3010(2)	DADS1375	MOVED – Moved to media section
DADS3020	DADS0435	MOVED – Moved to archive section
DADS3030	DADS2300	MOVED – Moved to backup section. Clarified
DADS3040	DADS2270	DELETED – Subsumed by DADS2270
DADS3055		DELETED – Limits design choice
	DADS3115	MOVED – Moved from DADS2630
	DADS3120	MOVED – Moved from DADS2640
	DADS3125	MOVED/MODIFIED – Clarified. – Moved from DADS2660
	DADS3130	MOVED/MODIFIED – Clarified. – Moved from DADS2670
	DADS3135	NEW – Requirement to support table 7,5.2.4-1
	DADS3140	NEW – Requirement addressing APIs
	DADS3150	NEW – Requirement addressing APIs
	DADS3160	NEW – Requirement addressing APIs

IMS ELEMENT REQUIREMENTS CHANGE DETAIL

Original Req. ID	New Req. ID	Rationale For Change
	IMS-0005	NEW - IRDs specify interface requirement detail for external interfaces to this element.
IMS-0050		MODIFIED - Intent unclear as to why users should be able to edit their request histories. Users, without qualification, should not be able to edit historical data.
IMS-0070		MODIFIED - Reworded to better specify the interface to the SMC.
IMS-0085		MODIFIED – Authorized services for unregistered users is maintained at the SMC.
IMS-0090		MODIFIED - ESN provides the communication sevice while the IMS provides the users interface to it
IMS-0120		MODIFIED – Users should not have direct access to the information base performing the association, but to the user interface which applies the information base.
IMS-0140		MODIFIED - Removed "for example" clause.
IMS-0160		MODIFIED - Replaced "e.g." with "i.e."
IMS-0200	IMS-1665	MOVED to IMS 1665. Monitoring and reporting on system usage is an SMC function
IMS-0220		MODIFIED - "guide" replaces "catalog" for metadata
IMS-0230		MODIFIED - "guide" replaces "catalog" for metadata
IMS-0320		MODIFIED - "dynamic browsing" – there are no performance requirements or functional requirements at the DADS or PGS to do this.
	IMS-0356	NEW - Moved from IMS-0370. As modified, this is a metadata maintenance requirement.
IMS-0360		MODIFIED - Reworded to allow flexibility in considering implementation options which may involve providing access to the GCMD, as an alternative to those requiring ECS to maintain its own directory.
IMS-0370		MOVED to IMS0356 - Moved to metadata management section. Allows flexibility for manual and/or automated creation and update of entires.
IMS-0380		MODIFIED - Clarified. The CAPABILITY to exchange directory entries should be provided via appropriate standards and procedures; ACTUAL exchange should take place as appropriate depending on implementation option chosen.
IMS-0390		MODIFIED - Generalizes requirements; access to ADC, etc, directory entries may be via the same mechanism as access to EOS directory entries depending on the implementation chosen.
IMS-0400		DELETED - Covered by IMS-0356 as modified.

IMS ELEMENT REQUIREMENTS CHANGE DETAIL (continued)

IMS-0410		MODIFIED - "guide" replaces "catalog" for metadata
IMS-0420		MODIFIED - "guide" replaces "catalog" for metadata
IMS-0460		MODIFIED - redundant with IMS-0450 and IMS-0455
IMS-0480		MODIFIED "ingest" implies a specific process involving hardware. Cost impact since DADS already has ingest capability and hw..
IMS-0490		MODIFIED "ingest" implies a specific process involving hardware. Requirement now clarified to scope what digital text formats will be supported, rather than "a number of digital text formats"
IMS-0580		MODIFIED - "geophysical" is interpreted as geophysical parameters, the visual subsetting of which should be covered by data visualization requirements. "surface features" refers to immovable physical characteristics (mountains, rivers, etc)
IMS-0590	DADS 2582 DADS 2490	MOVED to DADS 2582 and DADS 2490. Media distribution is a DADS function.
IMS-0600		MODIFIED - replaced "Earth Science master Directory" with GCMD.
IMS-0620		MODIFIED - scope of ADC's and ODC's appear earlier in the spec so it should be referenced here.
	IMS-0625	NEW - Interoperability with Version 0 is required by the SOW but there was no Level 3 requirement for it.
IMS-0640		MODIFIED - Removed "such as" and leaves option for project standard geographic names database.
IMS-0665		MODIFIED - Removed redundancy. "any time intensive operation" includes "time intensive query".
IMS-0720		MODIFIED - previous wording implied ad hoc browse for which there are no performance requirements. New wording removed reference to browse but keeps ad hoc processing and aligns with corresponding DADS requirement, DADS0740.
IMS-0730		MODIFIED - subsetting requires access to DADS resources and internal scheduling information in order to make an estimation.
IMS-0820		MODIFIED - Wording made consistent with other requirements for request interfaces.
IMS-0850	IMS-1646	MOVED to IMS1646 - history logging is an SMC function
	IMS-0915	NEW - Added functional requirement for providing data order capability from ECS to Version 0. Capability is mentioned in SOW but no previous level 3 requirement existed.

IMS ELEMENT REQUIREMENTS CHANGE DETAIL (continued)

IMS-0940		MODIFIED - to indentify IMS as performing this function
IMS-0990		MODIFIED. "Enable" implies that processing is started. Existence of lower level products for rquesting processing can be done from IMS but actual scheduling must be done at PGS.
IMS-1010		MODIFIED - Wording made consistent with other requirements for request interfaces.
IMS-1050		MODIFIED - Limits scope to preclude individual notifications from the IMS to users.
IMS-1090		MODIFIED - EOC no longer coordinates DARs for EOS.
IMS-1190		MODIFIED - Limits scope to parameter validation using pre-existing constraint information provided by instrument and spacecraft expertise at the ICC and the EOC.
IMS-1200		MODIFIED - EOC no longer coordinates DARs for EOS.
IMS-1230		MODIFIED - Wording made consistent with other requirements for request interfaces.
IMS-1340		MODIFIED - Cost estimation requires information from the SMC.
IMS-1350		MODIFIED - Removed "mutually agreed upon" --redundant with MOU
IMS-1385	IMS-1385	NEW - added in reference to paragraph 7.5.2.1.9
IMS-1400		MODIFIED - Specifies that the DBMSs at the SCFs will be one of the ECS supported DBMS rather than "to be determined", otherwise there is a cost impact.
IMS-1440		MODIFIED - Deleted "Performance Tuning". This function is specific to the physical implementation of the DBMS. Cost impact if generalized tools are to be provided.
IMS-1500		MODIFIED - "guide" replaces "catalog" for metadata. "Automatic generation" without any user / data provider interface is a cost impact.
IMS-1510		MODIFIED - Specifies that the workstations must be one of the ECS supported workstations rather than "user workstations", otherwise there is a cost impact.
IMS-1550		MODIFIED - more specific than "manipulation" for cost/COTS selection purposes
IMS-1595	IMS-1595	NEW- Added to trace to Change Order #1 APIs requirements.
IMS-1600		MODIFIED - services are provided by ESN while IMS only provides the user interface. ESN has no multimedia mail reqts.
IMS-1620	IMS-1620	NEW - Requirement for management data to be provided to the SMC added for system-wide consistency.

IMS ELEMENT REQUIREMENTS CHANGE DETAIL (continued)

IMS-1630		MODIFIED - "via the LSM" is too design specific. Interface should be at the element level for the level 3 requirement. Configuration management tools are not sent from the SMC to the IMS, but directives (flow down of policy) are maintained and provided by the SMC.
IMS-1640		MODIFIED - "via the LSM" is too design specific. Interface should be at the element level for the level 3 requirement. Items c,f and g are redundant with the new IMS-1620. Item h is redundant with IMS-1645.
IMS-1646	IMS-1646	NEW - derived from IMS0850 - history logging is an SMC function
IMS-1660		MODIFIED - history logging is an SMC function
IMS-1665		MOVED from IMS-0200
IMS-1670		DELETED - redundant with IMS 1665
IMS-1680		MODIFIED - corrected typo from "redefined" to "predefined"
IMS-1700		MODIFIED - IMS provides performance manangement data to the SMC, and "IMS Performance summaries" are generated by the SMC (IMS-1620)
IMS-1760		MODIFIED - IMS will send fault management information to the SMC.
IMS-1790		MODIFIED - "guide" replaces "catalog" for metadata. "LSM data" and "histograms" are stored by the LSM. Science processing library software and documents are stored at the DADS. "User workspace" cannot be adequately sized. Should be a TBR because it will introduce additional cost.

CSMS Section 8. Change Rationale Summary

The rationale for the suggested changes to the CSMS section of DID216 can be categorized as follows:

a) Design oriented details and implementation issues
b) Compliance with the GOSIP-2 specification
c) Network security related issues
d) Interfacing issues
e) Man in the loop issues
f) Rewording for clarification and consistency

- *Design & Implementation Details* -- Several requirements, which were deleted or modified, specified design details. These requirements will be included within the Level-IV requirements. See the detailed rationale table, which follows, for a complete list of those requirements deleted or modified for this reason.

- *GOSIP-2 Compliance* -- Some of the requirements with ISO standards compliance content have been reworded to support ISO/OSI data communication protocols and services to the extent specified in GOSIP-2, where practical, for all communication services.

- *Network Security Issues* -- Some network security requirements were too absolute. They were reworded to be compliant with recognized network security management standards such as GNMP.

- *Interfaces* -- Issues such as ESN's interface to PSCN for DAAC-to-DAAC backbone services and its interface to GFE NSI gateways to provide access to external user networks have been clarified.

- *Man-in-the-Loop vs. Automation Issues* -- The SMC section contains many requirements that imply certain staff interactions. Attempts have been made to distinguish between automation and man-in-the-loop type functions. For example SMC-2520 is possible only with the intervention of an SMC staff.

- *Clarifications & Requirements Consistency* -- Several requirements referred to the ESN to provide system capabilities. These were reworded to refer to the ESN as a network and not as a system. See the detailed rationale table for a complete list of the requirements modified or deleted for these reasons.

- *Testability Concerns* -- Several words such as maintain, evaluate, monitor and behavior have been used in the specification. These words usually create requirements that are not testable. Requirements using these words were reworded to improve clarification for testing purposes. See the detailed rationale table for a complete list of the requirements modified for this reason.

CSMS SECTION 8. REQUIREMENTS CHANGE DETAIL

Original Req. ID	New Req. ID	Rationale For Change
new	SMC-0005	DERIVED– Needed to specify external elements with which SMC shall interface
new	SMC-1000	DERIVED– Required to provide both CO #1 management API support and to match new other-element derived requirements for providing management data
SMC-1300		MODIFIED– "support" is redundant (assumed to be included in "maintain")
SMC-1310		MODIFIED– "support" is redundant (assumed to be included in "maintain")
SMC-1320		MODIFIED– "support" is redundant (assumed to be included in "maintain")
SMC-1330		MODIFIED– "support" is redundant (assumed to be included in "maintain"). Also reworded for clarification regarding processing information
SMC-1360		MODIFIED– Requirement is assumed for both, so "and" is more appropriate in specification than "or" (also improves testability)
SMC-1500		MODIFIED– "Provide" services is clearer than "perform" services
SMC-1600		MODIFIED– "e.g." to "i.e." for testability.
SMC-1610		MODIFIED– The example is unnecessary and is too absolute to be a considered to be a potential requirement
SMC-2100		MODIFIED– Items g. and h. modified to scope the requirement properly
SMC-2120		MODIFIED– Most users are ineligible for ECS funded license toolkit software
SMC-2500		MODIFIED– Requirement clarified to reflect intent for inventory management
SMC-2510		MODIFIED– CM is required for non-operational components as reflected in other CSMS requirements. Further rewording improves testability and clarifies intent
SMC-2520		MODIFIED– Requirement can only be considered applicable to SMC staff
SMC-2530		MODIFIED– All changes require management, not just those for enhancements
SMC-2540		MODIFIED– All changes require implementation management, not just those for algorithms
SMC-2600		MODIFIED– "support" and "control" are redundant (assumed to be included in "maintain")
SMC-2610		MODIFIED– Reworded to improve clarity and testability
new	SMC-2620	DERIVED– Makes a numbered requirement of a "shall" in text of page 8-2.
SMC-3330		MODIFIED– "compare" is redundant (assumed to be included in "evaluate")
SMC-3340		MODIFIED– Benchmarks are a derived requirement cited for clarifying intent

CSMS SECTION 8. REQUIREMENTS CHANGE DETAIL (continued)

SMC-3380		MODIFIED– Requirement can only be considered applicable to SMC staff
SMC-3390		MODIFIED– Testability issue for wording: "appropriate."
SMC-3400		MODIFIED– Requirement can only be considered applicable to SMC staff
SMC-3421		MODIFIED– Requirement can only be considered applicable to SMC staff. Clarifies source of feedback to be the RRDB
SMC-4300		MODIFIED– "support" and "update" are redundant (assumed to be included in "maintain")
SMC-4320		MODIFIED– Reworded for clarification
SMC-5300		MODIFIED– "establish" "support" and "update" are redundant (assumed to be included in "maintain")
SMC-5320		MODIFIED– Cites derived requirement for all users and processes to be authenticated
SMC-5330		DELETED– The functions are covered in ESN-1360 and SMC-7300
SMC-6300		MODIFIED– "support" and "update" are redundant (assumed to be included in "maintain")
SMC-6310		'MODIFIED– Perform' and 'as needed' are redundant
SMC-6320		MODIFIED– 'Perform' and 'as needed' are redundant
SMC-6330		MODIFIED– "establish" and "update" are redundant (assumed to be included in "maintain")
SMC-6330a.		MODIFIED– Clarifies assumed intent that all production processes are tracked not just transport
SMC-6330b.		MODIFIED– Clarifies level of tracking intended to be that needed for audit as opposed to an undefined and too detailed "event" level
SMC-6360		MODIFIED– Makes specification consistent with the current interpretation that the user charging mechanism for product orders is based upon computer resource unit (CRU) accounting, not on monetary transfers.
SMC-6370		MODIFIED– Makes specification consistent with the current interpretation that the user charging mechanism for product orders is based upon computer resource unit (CRU) accounting, not on monetary transfers.
SMC-6380		MODIFIED– Clarifies intent of requirement
SMC-6390		MODIFIED– "establish" and "update" are redundant (assumed to be included in "maintain")

SMC-6410		MODIFIED– Makes specification consistent with the current interpretation that the user charging mechanism for product orders is based upon computer resource unit (CRU) accounting, not on monetary transfers.
SMC-7300		MODIFIED– "establish" and "update" are redundant (assumed to be included in "maintain")
SMC-7300c.		MODIFIED– Cites derived requirement for group and individual privilege
SMC-7310		MODIFIED– "establish" and "update" are redundant (assumed to be included in "maintain")
SMC-7320		MODIFIED– "establish" and "update" are redundant (assumed to be included in "maintain")
SMC-7320d.		MODIFIED– "etc." is ambiguous, revised to clarify classifications required
SMC-8300		MODIFIED– "any...information" is too inclusive--rewording clarifies assumed intent
new	SMC-8400	DERIVED– Compress obsolete management data to avoid meaningless and resource wasteful data queries
SMC-8700		MODIFIED– "Current" is ambiguous
SMC-8710a.		MODIFIED– Cites derived requirement for configuration status to include all three types of software
SMC-8750a-c.		MODIFIED– Reworded to clarify and improve testability
SMC-8770a.		MODIFIED– Cites derived requirement for configuration status to include all three types of software
SMC-8790 d,e,f		MODIFIED– Intent clarification
SMC-8800c.		MODIFIED– Clarifies assumed intent of requirement for a free-text field to record information about failure to meet schedule
SMC-8800f.		MODIFIED– Clarifies assumed intent of requirement to be for reporting service time
SMC-8820		MODIFIED– Clarifies intent of requirement
SMC-8840		MODIFIED– Requirement can only be considered applicable to SMC staff
SMC-8841		MODIFIED– Requirement can only be considered applicable to SMC staff
SMC-8860c.&d.		MODIFIED– Clarifies assumed intent of requirement for a free-text field to record information about faults
SMC-8880		MODIFIED– Requirement can only be considered applicable to SMC staff
SMC-8880a.-g.		MODIFIED– Clarifies assumed intent of requirement for a free-text field to record information about security compromises
SMC-8890		MODIFIED– Requirement can only be considered applicable to SMC staff

SMC-1305		MODIFIED– Improves testability by establishing specific functional capability ("serve as a window" being considered too vague)
SMC-1315		MODIFIED– Improves testability by establishing specific functional capability ("serve as a window" being considered too vague)
SMC-1325		DELETED– Subsumed by SMC-1335
SMC-1335		MODIFIED– Cites derived requirement for SMC-LSM scheduling information to be bi-directional. Plus, partial move of items a. through d. from SMC-1325.
SMC-2105		MODIFIED– Improves testability ("convey" being considered too vague). Clarifies intent of requirement for LSM to deal with local events for its site or for its element, as applicable to the design implementation
SMC-2105g.-h.		MODIFIED– Items g. and h. modified to scope the requirement properly
SMC-2115		MODIFIED– mproves testability ("convey" being considered too vague). Clarifies intent of requirement for LSM to deal with local implementation for its site or for its element, as applicable to the design implementation
SMC-2215		MODIFIED– Requirement can only be considered applicable to SMC staff
SMC-2405		MODIFIED– Requirement can only be considered applicable to SMC staff
SMC-2515		MODIFIED– Clarifies intent of requirement for LSM to deal with local CM for its site or for its element, as applicable to the design implementation. Cites derived requirement for toolkit software to be included
SMC-2525	SMC-2535	MODIFIED–RENUMBERED– Clarifies intent for all changes (not just enhancements) to be accommodated. Clarifies intent of requirement for LSM to deal with local implementation management for its site or for its element, as applicable to the design implementation. Renumbered to re-establish proper SMC-nnn0 "parent" relationship for traceability
SMC-2605		MODIFIED– Reworded to remove redundancy
SMC-3315		MODIFIED– Clarifies intent of requirement for LSM to deal with its site or its element, as applicable to the design implementation
SMC-3335		MODIFIED– "compare" is redundant (assumed to be included in "evaluate"). Clarifies intent of requirement for LSM to deal with its site or its element, as applicable to the design implementation
SMC-3345a.		MODIFIED– Benchmarks are a derived requirement cited for clarifying intent

CSMS SECTION 8. REQUIREMENTS CHANGE DETAIL (continued)

SMC-3355		MODIFIED– Clarifies assumed intent of requirement and removes ambiguity of "implement"
SMC-3365	SMC-3375	MODIFIED– RENUMBERED– "limit checked" considered design detail. Cites derived requirement for establishing performance parameters. Renumbered to re-establish proper SMC-nnn0 "parent" relationship for traceability
SMC-3375	SMC-3385	MODIFIED– RENUMBERED– Clarifies intent of requirement for LSM to deal with its site or its element, as applicable to the design implementation. Renumbered to re-establish proper SMC-nnn0 "parent" relationship for traceability
SMC-3385	SMC-3395	MODIFIED– RENUMBERED– "limit check" considered a design detail. Renumbered to re-establish proper SMC-nnn0 "parent" relationship for traceability
SMC-3395	SMC-3397	MODIFIED– RENUMBERED– "as needed" untestable and unnecessary. "directive" is more inclusive than "request reflecting derived requirement. Renumbered to re-establish proper SMC-nnn0 "parent" relationship for traceability
SMC-3405	SMC-3415	MODIFIED– RENUMBERED– Clarifies intent of requirement for LSM to deal with its site or its element, as applicable to the design implementation. Renumbered to re-establish proper SMC-nnn0 "parent" relationship for traceability
SMC-4305		MODIFIED– Clarifies intent of requirement for LSM to deal with its site or its element, as applicable to the design implementation
SMC-4315		MODIFIED– Clarifies intent of requirement for LSM to deal with its site or its element, as applicable to the design implementation. Specific fault levels to be specified as function of RMA design
SMC-4325a.		MODIFIED–"tolerance" ambiguous
SMC-4325b.		MODIFIED–"resource-to-resource" unnecessary
SMC-4335		MODIFIED–exception more clearly stated
SMC-5325		MODIFIED– Cites derived requirement for all users and processes to be authenticated
SMC-5335		DELETED– because the functions are covered in ESN-1360 and ESN-7300
SMC-5345		MODIFIED– Clarifies intended depth of requirement rather than specific instances
SMC-5355		DELETED– Design detail considered inappropriate for functional specification
SMC-5365	SMC-5355	MODIFIED–RENUMBERED– Just renumbered.

CSMS SECTION 8. REQUIREMENTS CHANGE DETAIL (continued)

SMC-6305	SMC-6315	MODIFIED–RENUMBERED– "as needed" untestable and unnecessary. Clarifies intent of requirement for LSM to deal with its site or its element, as applicable to the design implementation. Renumbered to re-establish proper SMC-nnn0 "parent" relationship for traceability
SMC-6315	SMC-6325	MODIFIED–RENUMBERED– "as needed" untestable and unnecessary. Clarifies intent of requirement for LSM to deal with its site or its element, as applicable to the design implementation. Renumbered to re-establish proper SMC-nnn0 "parent" relationship for traceability
SMC-6325	SMC-6335	MODIFIED–RENUMBERED– "as needed" untestable and unnecessary. "update" considered a specific instance of "maintain" and unncessary. Renumbered to re-establish proper SMC-nnn0 "parent" relationship for traceability
SMC-6325a.	SMC-6335a.	MODIFIED–RENUMBERED– Clarifies assumed intent that all production processes are tracked not just transport
SMC-6325b.	SMC-6335b.	MODIFIED–RENUMBERED– Clarifies level of tracking intended to be that needed for audit as opposed to an undefined and too detailed "event" level
SMC-6335	SMC-6545	MODIFIED–RENUMBERED– "as needed" untestable and unnecessary.Slight improvement in intent of requirement. Renumbered to re-establish proper SMC-nnn0 "parent" relationship for traceability
SMC-6355	SMC-6385	MODIFIED–RENUMBERED– "as needed" untestable and unnecessary. Clarifies intent of requirement for LSM to deal with its site or its element, as applicable to the design implementation. Renumbered to re-establish proper SMC-nnn0 "parent" relationship for traceability
SMC-8705		MODIFIED– Clarifies intent of requirement for LSM to deal with its site or its element, as applicable to the design implementation
SMC-0340		MODIFIED– Clarifies assumed intent to respond to detected faults
SMC-0350		MODIFIED– Clarifies assumed intent to respond to detected compromises
new	ESN-0002	DERIVED– Needed to specify external elements with which ESN shall interface
ESN-0005		MODIFIED– Clarity
ESN-0006		MODIFIED– Requirement reworded to reflect interface with external networks
ESN-0007		MODIFIED– Clarified.
ESN-0010c		MODIFIED– Clarified.

CSMS SECTION 8. REQUIREMENTS CHANGE DETAIL (continued)

ESN-0010h		MODIFIED– The gateway/hub specified in 'h' is too design oriented.
ESN-0010i		MODIFIED– Item i added to list for completeness.
ESN-0080		MODIFIED– Indication of GFP circuit interface.
ESN-0090		DELETED– Subsumed by ESN 1206 & ESN1207
ESN-0180		MODIFIED– Clarification regarding IP I/F.
ESN-0210		MODIFIED– Stronger wording to show ESN's involvement in status collection.
ESN-0240		MODIFIED– Adding 'design' clarifies the intent of the requirement.
ESN-0280		MODIFIED– FTAM should be governed by GOSIP clause 1330 for interoperabiliy. Items a,b,c and d are data types not document types.
ESN-0360	ESN-1330	DELETED– Redundant GOSIP requirement. Subsumed by ESN-1330.
ESN-0340		MODIFIED– Consistency with NASA's new policy for e-mail interoperability.
ESN-0350		MODIFIED– GOSIP clause 1330 governs interoperability.
ESN-0370		MODIFIED– Compliance to the extent specified in GOSIP. Partially subsumed by ESN-1330.
ESN-0490		MODIFIED– Compliance to the extent specified in GOSIP.
ESN-0590		MODIFIED– Clarifies intent of requirement.
ESN-0600		MODIFIED– Clarification for testability (remove "appropriate.")
ESN-0610		MODIFIED– Rewording for clarification and consistency.
ESN-0640		MODIFIED– Can't manage components in interface networks.
ESN-0650		MODIFIED– May not need to manage at each layer; Rewording to remove redundancy
ESN-0690		MODIFIED– Requirement was too absolute.
ESN-0700		MODIFIED– Redundant wording taken out.
ESN-0740		MODIFIED– Level 4 or lower details taken out.
ESN-0750		MODIFIED– Level 4 or lower details taken out.
ESN-0760		MODIFIED– ESN is a network. The network and not the system is to be managed. Reworded for consistency.
ESN-0770		MODIFIED– Reworded for consistency.
ESN-0910d.	ESN-0775	MOVED– Redirection of reports is needed for all of the Network Management functions. Generalized from ESN-0910d. Partial (item d.) moved.
ESN-0780		MODIFIED– Specifying 'gateway' or 'hub' is too design oriented.
ESN-0790		MODIFIED– The deleted portion in item b is a directory service and is a separate requirement.(ESN-0610).

ESN-0800		MODIFIED-- Clarifies intent of requirement.
ESN-0810		MODIFIED-- Only detected faults can be diagnosed.
ESN-0830		MODIFIED-- Removed redundancy and made consistent.
ESN-0900 f.		MODIFIED-- Item f is not a network function and is covered by SMC fault management.
ESN-0910		MODIFIED-- Redirection of reports is needed for all the Network Management functions. Item d moved to ESN-0775 as a new requirement.
ESN-1010		MODIFIED-- Assumption is that packet tracing is used as a debugging tool only.
ESN-1030		MODIFIED-- The word 'backup' implies a dedicated link. This is design. An example for "alternate communication capabilities" would be switched service.
ESN-1060		MODIFIED-- The word 'network' is redundant. 'performance' is more specific than 'behavior'. 'OSI' does not make sense in the requirement's context.
ESN-1065		MODIFIED-- 'allowing reconfiguration to prevent disruption of service' is redundant.
ESN-1070 a,c and d		MODIFIED-- ESN is a network. The network and not the system is to be managed.
ESN-1360		MODIFIED-- Requirement is too absolute. Not testable in its original form.
ESN-1365		MODIFIED-- Stronger wording to show isolation of FOS.
new	ESN-1367	DERIVED-- Remote IST users must connect to FOS via secure interfaces and sessions for added protection of FOS.
ESN-1380 b		MODIFIED-- Spelling mistake.
ESN-1380 c		MODIFIED-- Reworded for specificity.
ESN-1380 d,e and f		DELETED-- (Subsumed) Items d,e and f in the original requirement are subsumed in the new item d
ESN-1400		MODIFIED-- Need Scope note; not all services apply to all network activities. For example, we don't provide confidentiality on electronic product orders.
ESN-1430		MODIFIED-- Reworded for clarification.
ESN-0200	SMC-5345	DELETED-- Subsumed by SMC-5345. Virus removal is not a network function.
ESN-1140		MODIFIED-- Gateway is too design oriented.
ESN-1170		MODIFIED-- Gateway is too design oriented. 'Application layer services' is too vague.
new	ESN-1180	DERIVED-- Required for consistency with NSI plans
new	ESN-1181	DERIVED-- Defines a standard against which the Bulletin Board service can be procured

ESN-1330		MODIFIED– 1) Per flowdown of level 2, will use GOSIP "where practical". 2) Used to say "for all communications" which is ambiguous. We assume this to mean all communication *services*, not all communication *instances*.
new	ESN-1340	DERIVED– TCP/IP support is required by many ECS users, especially for early ECS releases
ESN-1361	ESN-0180 ESN-1340	DELETED– It is covered under ESN-0180 and ESN-1340

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Appendix G. Requirements To System Release Mapping Tables

Appendix G provides a mapping of ECS requirements to system releases.

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Legend:

P....."Preliminary"

F....."Final"

U....."Update"

System-Level Requirement-to-Release Mappings:

Requirement ID	R1	R1.1	R2	R2.1	R3	R4	R5	R6
EOSD0010			P		F			
EOSD0015			P		F			
EOSD0020			P		P	F		
EOSD0025			P		F			
EOSD0030	P					F		
EOSD0040			F					
EOSD0500	P		P		P	F		
EOSD0502					P	F		
EOSD0510			P		P	F		
EOSD0540					P	F		
EOSD0545			P		P	F		
EOSD0560					P	F		
EOSD0630	P		P		P	F		
EOSD0700					P	F		
EOSD0710					P	F		
EOSD0720					P	F		
EOSD0730	P		P		P	F		
EOSD0740					P	F		
EOSD0750					P	F		
EOSD0760			P		P	F		
EOSD0780	P		P		P	F		
EOSD0800					P	F		
EOSD1000						F		
EOSD1010						F		
EOSD1030						F		
EOSD1040							F	
EOSD1050						F		
EOSD1060						F		
EOSD1070						F		
EOSD1080						F		
EOSD1140	P		P		P	F		
EOSD1480						F		
EOSD1490						F		
EOSD1500			P		P	F		
EOSD1680			P		P	F		
EOSD1690			P		P	F		
EOSD1502			P		P	F		
EOSD1505			P		P	F		
EOSD1506	F							
EOSD1510			P		F			
EOSD1520			P		F			
EOSD1530			P		F			
EOSD1600			P		F			

System-Level Requirement-to-Release Mappings:

Requirement ID	R1	R1.1	R2	R2.1	R3	R4	R5	R6
EOSD1605			P		F			
EOSD1607				P	F			
EOSD1608			P	P	F			
EOSD1710			F					
EOSD1720	P				F			
EOSD1730	P				F			
EOSD1740	P		F					
EOSD1750	P				F			
EOSD1760	P				P	F		
EOSD1770					F			
EOSD1990						F		
EOSD2100						F		
EOSD2200	P		P		P	F		
EOSD2400	P		F					
EOSD2430	P		F					
EOSD2440	P		P		F			
EOSD2510	P		P		P	F		
EOSD2550	F							
EOSD2620					P	F		
EOSD2640					P	F		
EOSD2650			P		F			
EOSD2660			P		F			
EOSD2710						F		
EOSD2990						F		
EOSD3000	P		P		P	F		
EOSD3200	P		P		P	F		
EOSD3220	P		P		P	F		
EOSD3490						F		
EOSD3492						F		
EOSD3495						F		
EOSD3500						F		
EOSD3510						F		
EOSD3600						F		
EOSD3610						F		
EOSD3615						F		
EOSD3620						F		
EOSD3625						F		
EOSD3630						F		
EOSD3700						F		
EOSD3800						F		
EOSD3710						F		
EOSD3810						F		
EOSD3820						F		
EOSD3900						F		
EOSD3910						F		
EOSD3920						F		
EOSD3930						F		
EOSD3940						F		
EOSD3950						F		
EOSD3960						F		
EOSD3970						F		

System-Level Requirement-to-Release Mappings:

Requirement ID	R1	R1.1	R2	R2.1	R3	R4	R5	R6
EOSD3980						F		
EOSD3990						F		
EOSD4000						F		
EOSD4010						F		
EOSD4020						F		
EOSD4030						F		
EOSD4035						F		
EOSD4036						F		
EOSD4100						F		

FOS Segment Requirement to Release Mapping Table:

Requirement ID	R1	R1.1	R2	R2.1	R3	R4	R5	R6
FOS-0020					P	F	U	U
FOS-0025					P	F	U	U
FOS-0030			P		P	F	U	U
FOS-0040			P		P	F	U	U
FOS-0045			P		P	F	U	U
FOS-0050			P		P	F	U	U
FOS-0060			P		P	F	U	U
FOS-0070			P		P	F	U	U
EOC-0005			P		P	F	U	U
EOC-0020			P		P	F	U	U
EOC-0030			P		F			
EOC-0040			P		F	U	U	U
EOC-1005			P		F			
EOC-2005			P		P	F	U	U
EOC-2010			P		P	F	U	U
EOC-2030			P		P	F	U	U
EOC-2040			P		P	F	U	U
EOC-2045			P		P	F	U	U
EOC-2070			P		P	F	U	U
EOC-2160			P		P	F	U	U
EOC-2170			P		P	F	U	U
EOC-2180			P		P	F	U	U
EOC-2190			P		P	F	U	U
EOC-2200			P		P	F	U	U
EOC-2205			P		P	F	U	U
EOC-2210			P		P	F	U	U
EOC-2220			P		P	F	U	U
EOC-2230			P		P	F	U	U
EOC-2240			P		P	F	U	U
EOC-2250			P		P	F	U	U
EOC-2260			P		P	F	U	U
EOC-2270			P		P	F	U	U
EOC-2272			P		P	F	U	U
EOC-2280			P		P	F	U	U
EOC-2290			P		P	F	U	U
EOC-2300			P		P	F	U	U
EOC-2310			P		P	F	U	U
EOC-2320			P		P	F	U	U
EOC-2350			P		P	F	U	U
EOC-2370			P		P	F	U	U
EOC-2400			P		P	F	U	U
EOC-2405			P		P	F	U	U
EOC-2410			P		P	F	U	U
EOC-2420			P		P	F	U	U
EOC-2430			P		P	F	U	U
EOC-2460			P		P	F	U	U
EOC-2480			P		P	F	U	U
EOC-2482			P		P	F	U	U
EOC-2490			P		P	F	U	U
EOC-2510			P		P	F	U	U

FOS Segment Requirement to Release Mapping Table:

Requirement ID	R1	R1.1	R2	R2.1	R3	R4	R5	R6
EOC-2520			P		P	F	U	U
EOC-2530			P		P	F	U	U
EOC-2535			P		P	F	U	U
EOC-2540			P		P	F	U	U
EOC-2550			P		P	F	U	U
EOC-2555			P		P	F	U	U
EOC-2560			P		P	F	U	U
EOC-2570			P		P	F	U	U
EOC-2590			P		P	F	U	U
EOC-2620			P		P	F	U	U
EOC-2630			P		P	F	U	U
EOC-3015			P		F	U	U	U
EOC-3017			P		F	U	U	U
EOC-3020			P		F	U	U	U
EOC-3024			P		F	U	U	U
EOC-3030			P		F	U	U	U
EOC-3050			P		F	U	U	U
EOC-3070			P		F	U	U	U
EOC-3080			P		F	U	U	U
EOC-3085			P		F	U	U	U
EOC-3086			P		F	U	U	U
EOC-3090			P		F	U	U	U
EOC-3160			P		F	U	U	U
EOC-3200			P		F	U	U	U
EOC-3210			P		F	U	U	U
EOC-3225			P		F	U	U	U
EOC-3226			P		F	U	U	U
EOC-3238			P		F	U	U	U
EOC-4005			F					
EOC-4008			F					
EOC-4010			F				U	U
EOC-4015			F					
EOC-4017					F			
EOC-4018			F					
EOC-4020			F					
EOC-4060			F					
EOC-4100						F		
EOC-4120					F		U	U
EOC-4125					F		U	U
EOC-4130			F					
EOC-4140					F			
EOC-4160					F			
EOC-4166					F			
EOC-4168					F			
EOC-4200			F					
EOC-4210			F					
EOC-5010			F				U	U
EOC-5012					F		U	U
EOC-5015			F				U	U
EOC-5020					F		U	U
EOC-5030					F			

FOS Segment Requirement to Release Mapping Table:

Requirement ID	R1	R1.1	R2	R2.1	R3	R4	R5	R6
EOC-5045			F				U	U
EOC-5050					F			
EOC-5070					F			
EOC-5080			F				U	U
EOC-5090					F		U	U
EOC-5100					F			
EOC-5105					F			
EOC-5110					F			
EOC-5120					F			
EOC-5130						F		
EOC-5180					F		U	U
EOC-5185					F			
EOC-5187						F	U	U
EOC-5190					F			
EOC-5200					F			
EOC-5220			F				U	U
EOC-5230					F			
EOC-5240					F		U	U
EOC-6010			P		P	F	U	U
EOC-6020			P		F	U	U	U
EOC-6050			P		F	U	U	U
EOC-6060			P		F	U	U	U
EOC-6070			P		F	U	U	U
EOC-6080			P		P	F	U	U
EOC-6100			P		F	U	U	U
EOC-6110			P		P	F	U	U
EOC-6130			P		F	U	U	U
EOC-6135			P		P	F	U	U
EOC-6140			P		F	U	U	U
EOC-6150			P		F	U	U	U
EOC-6160			P		F	U	U	U
EOC-6170			P		P	F	U	U
EOC-6195			P		P	F	U	U
EOC-6200			P		P	F	U	U
EOC-6210			P		P	F	U	U
EOC-7010			P		P	F	U	U
EOC-7015			P		P	F	U	U
EOC-7020			P		F	U	U	U
EOC-7025			P		F	U	U	U
EOC-7030			P		F	U	U	U
EOC-7040			P		F	U	U	U
EOC-7045			P		F	U	U	U
EOC-7060			P		F	U	U	U
EOC-7110			P		F	U	U	U
EOC-7115			P		F	U	U	U
EOC-7116			P		F	U	U	U
EOC-7120			P		F	U	U	U
EOC-7125			P		F	U	U	U
EOC-7130			P		F	U	U	U
EOC-7140			P		F	U	U	U
EOC-7150			P		F	U	U	U

FOS Segment Requirement to Release Mapping Table:

Requirement ID	R1	R1.1	R2	R2.1	R3	R4	R5	R6
EOC-7160			P		F	U	U	U
EOC-8005					P	F	U	U
EOC-8010						F		
EOC-8020						F		
EOC-8090					F			
EOC-8100						F		
EOC-8110					F			
EOC-8130					F			
EOC-8140					F			
EOC-8150						F		
EOC-8160					F			
EOC-8220						F		
EOC-8230						F		
EOC-8240						F		
EOC-8250			F					
EOC-8260						F		
EOC-8270						F		
EOC-8285						F	U	U
EOC-8290						F	U	U
EOC-8320						F	U	U
EOC-8330						F		
EOC-8370						F		
EOC-8372						F		
EOC-8375						F		
EOC-8380						F		
EOC-9010			P		P	F	U	U
EOC-9020			P		P	F	U	U
EOC-9025			P		F	U	U	U
EOC-9040			P		F	U		
EOC-9080					F	U	U	U
EOC-9090					P	F	U	U
EOC-9110			F					
EOC-9130			F					
EOC-9510			P		P	F	U	U
EOC-9520			P		P	F	U	U
EOC-9570			P		P	F	U	U
EOC-9580			P		P	F	U	U
EOC-9590			P		P	F	U	U
ICC-0005			P		P	F	U	U
ICC-0010					P	F	U	U
ICC-0020			P		F	U	U	U
ICC-0030			P		P	F	U	U
ICC-0040			P		F	U	U	U
ICC-0050			P		P	F	U	U
ICC-0055			P		F	U	U	U
ICC-0070			P		F	U	U	U
ICC-1010					F			
ICC-1020					P	F		
ICC-1040					P	F		
ICC-1041						P	P	F

FOS Segment Requirement to Release Mapping Table:

Requirement ID	R1	R1.1	R2	R2.1	R3	R4	R5	R6
ICC-1042						P	P	F
ICC-1044						P	P	F
ICC-1050						P	P	F
ICC-1060						P	P	F
ICC-1070						P	P	F
ICC-1080						P	P	F
ICC-1082						P	P	F
ICC-1090						P	P	F
ICC-1100						P	P	F
ICC-1105						P	P	F
ICC-1110						P	P	F
ICC-1115						P	P	F
ICC-1130						P	P	F
ICC-1140						P	P	F
ICC-1150						P	P	F
ICC-1160						P	P	F
ICC-1170						P	P	F
ICC-2010			P		P	F	U	U
ICC-2015			P		P	F	U	U
ICC-2017			P		P	F	U	U
ICC-2020			P		P	F	U	U
ICC-2050			P		P	F	U	U
ICC-2055			P		P	F	U	U
ICC-2060			P		P	F	U	U
ICC-2110			P		P	P	P	F
ICC-2115			P		P	P	P	F
ICC-2120			P		P	P	P	F
ICC-2130			P		P	P	P	F
ICC-2135			P		P	P	P	F
ICC-2140			P		P	F	U	U
ICC-2150			P		P	F	U	U
ICC-2170			P		P	F	U	U
ICC-2180			P		P	F	U	U
ICC-2190			P		P	P	P	F
ICC-2210			P		P	F	U	U
ICC-2220			P		P	F	U	U
ICC-2230			P		P	F	U	U
ICC-2250			P		P	F	U	U
ICC-2270			P		P	F	U	U
ICC-2280			P		P	F	U	U
ICC-2290			P		P	F	U	U
ICC-2300			P		P	F	U	U
ICC-2350			P		P	F	U	U
ICC-2370			P		P	F	U	U
ICC-2380			P		P	F	U	U
ICC-2390			P		P	F	U	U
ICC-2400			P		P	F	U	U
ICC-2410			P		P	F	U	U
ICC-2420			P		P	F	U	U
ICC-2430			P		P	F	U	U
ICC-2450			P		P	F	U	U

FOS Segment Requirement to Release Mapping Table:

Requirement ID	R1	R1.1	R2	R2.1	R3	R4	R5	R6
ICC-3010			P		F	U	U	U
ICC-3020			P		F	U	U	U
ICC-3040			P		F	U	U	U
ICC-3050			P		F	U	U	U
ICC-3060			P		F	U	U	U
ICC-3070			P		F	U	U	U
ICC-3071			P		F	U	U	U
ICC-3085			P		F	U	U	U
ICC-3090			P		F	U	U	U
ICC-3100			P		F	U	U	U
ICC-3110			P		F	U	U	U
ICC-3150			P		F	U	U	U
ICC-3160			P		F	U	U	U
ICC-3210					F		U	U
ICC-3220					F		U	U
ICC-3230					F		U	U
ICC-3240					F		U	U
ICC-3250					F		U	U
ICC-3262					F		U	U
ICC-3270					F		U	U
ICC-3280					F			
ICC-3300					F			
ICC-3360					F			
ICC-3370					F		U	U
ICC-3380					F			
ICC-3400					F		U	U
ICC-3420					F		U	U
ICC-3430					F		U	U
ICC-4010					F		U	U
ICC-4020			F					
ICC-4040			F				U	U
ICC-4045			F				U	U
ICC-4050					F		U	U
ICC-4060			F				U	U
ICC-4070					F			
ICC-4090					F			
ICC-4095					F			
ICC-4100			P		F		U	U
ICC-4110					F			
ICC-4120					F			
ICC-4130			F				U	U
ICC-4150					F			
ICC-4160					F		U	U
ICC-4170						F		
ICC-4180					F		U	U
ICC-4190					F			
ICC-4200					F			
ICC-4210			F					
ICC-4220			F				U	U
ICC-4230					F		U	U
ICC-4410			P		F	U	U	U

FOS Segment Requirement to Release Mapping Table:

Requirement ID	R1	R1.1	R2	R2.1	R3	R4	R5	R6
ICC-4412			P		F	U	U	U
ICC-4415			P		F	U	U	U
ICC-4420			P		F	U	U	U
ICC-4435			P		F	U	U	U
ICC-4440			P		F	U	U	U
ICC-4450			P		F	U	U	U
ICC-4460			P		F	U	U	U
ICC-4470			P		F	U	U	U
ICC-4480			P		F	U	U	U
ICC-4490			P		F	U	U	U
ICC-4500			P		F	U	U	U
ICC-4510			P		F	U	U	U
ICC-4520			P		F	U	U	U
ICC-4540			P		F	U	U	U
ICC-4545			P		F	U	U	U
ICC-4550			P		F	U	U	U
ICC-4560			P		F	U	U	U
ICC-4570			P		F	U	U	U
ICC-4580			P		F	U	U	U
ICC-4590			P		F	U	U	U
ICC-4600			P		F	U	U	U
ICC-4610			P		F	U	U	U
ICC-4710			P		P	F	U	U
ICC-4720			P		F	U	U	U
ICC-4730			P		F	U	U	U
ICC-4740			P		F	U	U	U
ICC-4750			P		F	U	U	U
ICC-4760			P		F	U	U	U
ICC-4765			P		F	U	U	U
ICC-4770			P		F	U	U	U
ICC-4775			P		P	F	U	U
ICC-4780			P		F	U	U	U
ICC-4790			P		F	U	U	U
ICC-4800			P		F	U	U	U
ICC-4810			P		F	U	U	U
ICC-4820			P		F	U	U	U
ICC-4830			P		F	U	U	U
ICC-6000					P	F	U	U
ICC-6005			P		P	F	U	U
ICC-6010			P					
ICC-6020			P		F			
ICC-6030			P			F		
ICC-6040			P		F			
ICC-6060			P		F			
ICC-6070			P		F	F		
ICC-6080			P					
ICC-6090			P		F			
ICC-6110			P			F		
ICC-6120			P			F		
ICC-6130			P			F		
ICC-6135			P			F		

FOS Segment Requirement to Release Mapping Table:

Requirement ID	R1	R1.1	R2	R2.1	R3	R4	R5	R6
ICC-6140			P			F		
ICC-6145			P			F		
ICC-6150			P			F	U	U
ICC-6195			P			F		
ICC-6200			P			F		
ICC-6205			P			F		
ICC-6210			P			F		
ICC-6510			P		P	F	U	U
ICC-6520			P		P	F	U	U
ICC-6525			P		F	U	U	U
ICC-6540			P		F	U		
ICC-6580					F	U	U	U
ICC-6590					P	F	U	U
ICC-6600			F					
ICC-6620			F					
ICC-7010			P		F	U	U	U
ICC-7030			P		F	U		
ICC-7050			P		F	U	U	U
ICC-7060					P	F	U	U
ICC-7070					P	F	U	U
ICC-7110						P	F	U
ICC-7150					P	F		
ICC-7170					P	F		
ICC-7180						P	P	F
ICC-7190						P	P	F
ICC-7200						P	P	F
ICC-7210			P		P	F	U	U
ICC-7214					P	F	U	U
ICC-7220			P		P	F	U	U
ICC-7230			P		P	F	U	U
ICC-7240			P		P	F	U	U
ICC-7250			P		P	F	U	U
ICC-7270			P		P	F	U	U
ICC-7290			P		F	U	U	U
ICC-7330			P		F	U	U	U
ICC-7350			P		F	U	U	U
ICC-7360			P		F	U	U	U
ICC-7370			P		F	U	U	U
ICC-7390			P		F	U	U	U
ICC-7400			P		F	U	U	U
ICC-7430			P		P	F	U	U
ICC-7460			P		F	U	U	U
ICC-7500			P		P	F	U	U
ICC-7510			P		F	U	U	U
ICC-7530					P	F	U	U
ICC-7550			P		F	U	U	U
ICC-8010			P		P	F	U	U
ICC-8020			P		P	F	U	U
ICC-8040			P		P	F	U	U
ICC-8050			P		P	F	U	U
ICC-8060			P		P	F	U	U

SDPS Segment Requirement-to-Release Mapping:

Requirement ID	R1	R1.1	R2	R2.1	R3	R4	R5	R6
SDPS0010	P		F					
SDPS0015			F					
SDPS0020	P		P		F			
SDPS0030			P		P	F		
SDPS0031			P		P	F		
SDPS0035			P		P	F		
SDPS0040					P	F		
SDPS0050			P		P	F		
SDPS0080			P		P	F		
SDPS0090	P					F		
SDPS0091			P		P	F		
SDPS0092						F		
SDPS0093						F		
SDPS0095	P		P		P	F		
SDPS0100			P		P	F		
SDPS0110			P		P	F		
SDPS0115			P		P	F		
SDPS0120						F		
SDPS0130			F					
SDPS0140	P		P		P	F		
SDPS0150					P	F		
SDPS0160					P	F		
SDPS0170	P		P		P	F		
SDPS0180			P		P	F		
PGS-0002	P		P		P	F		
PGS-0005					F			
PGS-0010					F			
PGS-0015					F			
PGS-0020					F			
PGS-0030					F			
PGS-0040					F			
PGS-0050			P			F		
PGS-0060			P			F		
PGS-0070			P			F		
PGS-0080					P	F		
PGS-0090					F			
PGS-0100					F			
PGS-0140					F			
PGS-0150					F			
PGS-0160			P		F			
PGS-0165			P		F			
PGS-0170			P		F			
PGS-0180			P		F			
PGS-0190			P		F			
PGS-0210	F							
PGS-0220			P		F			
PGS-0230			P		F			
PGS-0240			P		F			

SDPS Segment Requirement-to-Release Mapping:

Requirement ID	R1	R1.1	R2	R2.1	R3	R4	R5	R6
PGS-0250			P		F			
PGS-0255					F			
PGS-0256					F			
PGS-0260					F			
PGS-0270			F					
PGS-0285			P		F			
PGS-0290					F			
PGS-0295					F			
PGS-0300					F			
PGS-0310			P		P	F		
PGS-0320			P		F			
PGS-0325					F			
PGS-0330			P		P	F		
PGS-0360			P		F			
PGS-0400	F							
PGS-0410						F		
PGS-0435			P			F		
PGS-0440			F					
PGS-0450			F					
PGS-0455			F					
PGS-0456			F					
PGS-0458			F					
PGS-0470			P		F			
PGS-0480			P		F			
PGS-0490	P		P		F			
PGS-0500			P		F			
PGS-0510	P		P		F			
PGS-0520			P		F			
PGS-0530			P		F			
PGS-0540			P		F			
PGS-0550			P		F			
PGS-0560			P		F			
PGS-0590			P		F			
PGS-0600	F							
PGS-0602	F							
PGS-0605	P		P			F		
PGS-0610	F							
PGS-0620	F							
PGS-0630	P		F					
PGS-0640	F							
PGS-0650	F							
PGS-0860	P		P		F			
PGS-0870			P		P	F		
PGS-0900	F							
PGS-0910	F							
PGS-0920	F							
PGS-0925	F							
PGS-0930			P		F			
PGS-0940	P		P		F			
PGS-0950	P		P		F			
PGS-0960			F					

SDPS Segment Requirement-to-Release Mapping:

Requirement ID	R1	R1.1	R2	R2.1	R3	R4	R5	R6
PGS-0970	F							
PGS-0980	P		F					
PGS-0990	F							
PGS-1000	F							
PGS-1010	F							
PGS-1015	F							
PGS-1020	F							
PGS-1025	F							
PGS-1030	F							
PGS-1050			F					
PGS-1060	F							
PGS-1080			F					
PGS-1090			F					
PGS-1100			F					
PGS-1110			F					
PGS-1120			F					
PGS-1130			F					
PGS-1140			F					
PGS-1150			F					
PGS-1160			F					
PGS-1170			F					
PGS-1175			F					
PGS-1180			F					
PGS-1190			F					
PGS-1200			F					
PGS-1210			F					
PGS-1220	P		F					
PGS-1230			F					
PGS-1240			F					
PGS-1250			F					
PGS-1260			F					
PGS-1270			P		P	F		
PGS-1300			P		P	F		
PGS-1301			P		P	F		
PGS-1305						F		
PGS-1310			P		P	F		
PGS-1315	P		P		P	F		
DADS-0005	P		P		P	F		
DADS-0010			F					
DADS-0020			F					
DADS-0070					F			
DADS-0100			F					
DADS-0110	F							
DADS-0120			F					
DADS-0140			P		F			
DADS-0145			F					
DADS-0150			F					
DADS-0160			F					
DADS-0170					F			
DADS-0175			F					

SDPS Segment Requirement-to-Release Mapping:

Requirement ID	R1	R1.1	R2	R2.1	R3	R4	R5	R6
DADS-0180					F			
DADS-0190			F					
DADS-0200					F			
DADS-0210			F					
DADS-0220					F			
DADS-0240			F					
DADS-0250	P				F			
DADS-0260			F					
DADS-0281					F			
DADS-0282					F			
DADS-0290	P		P		P	F		
DADS-0300	P		P		P	F		
DADS-0310	P		P		P	F		
DADS-0320	P		P		P	F		
DADS-0350	F							
DADS-0360			F					
DADS-0370	F							
DADS-0405			F					
DADS-0410			P		F			
DADS-0412					F			
DADS-0425						F		
DADS-0430			F					
DADS-0435	F							
DADS-0440					F			
DADS-0450			F					
DADS-0460			P		P	F		
DADS-0465	P		P		P	F		
DADS-0470					F			
DADS-0475			F					
DADS-0488			F					
DADS-0490			F					
DADS-0498	P		F					
DADS-0500			F					
DADS-0520			F					
DADS-0525			F					
DADS-0540			F					
DADS-0550			F					
DADS-0570	P		F					
DADS-0590					F			
DADS-0600	F							
DADS-0660	P		P		P	F		
DADS-0690			P		F			
DADS-0700						F		
DADS-0730					F			
DADS-0740					F			
DADS-0760	P		P		P	F		
DADS-0770	P		P		P	F		
DADS-0780						F		
DADS-0800	P		P		P	F		
DADS-0880						F		
DADS-0890						F		

SDPS Segment Requirement-to-Release Mapping:

Requirement ID	R1	R1.1	R2	R2.1	R3	R4	R5	R6
DADS-0901	P		P		P	F		
DADS-0927			F					
DADS-0930					F			
DADS-0940	P		F					
DADS-0960	F							
DADS-1000			F					
DADS-1010			F					
DADS-1020	F							
DADS-1030			F					
DADS-1070	P		P		P	F		
DADS-1080	F							
DADS-1085	F							
DADS-1100	P		P		F			
DADS-1110	P		P		F			
DADS-1114	F							
DADS-1160			P		F			
DADS-1180			F					
DADS-1210			F					
DADS-1310			P		P	F		
DADS-1320			P		P	F		
DADS-1330					F			
DADS-1350						F		
DADS-1360						F		
DADS-1370						F		
DADS-1375	F							
DADS-1400					F			
DADS-1450					F			
DADS-1470					F			
DADS-1475			P		P	F		
DADS-1510					P	F		
DADS-1520	F							
DADS-1530	F							
DADS-1540			F					
DADS-1550					F			
DADS-1610					F			
DADS-1620	P		P		P	F		
DADS-1630					F			
DADS-1640						F		
DADS-1700						F		
DADS-1780	F							
DADS-1790					F			
DADS-1791	F							
DADS-1795			F					
DADS-1800	F							
DADS-1805	P					F		
DADS-1806	F							
DADS-1810						F		
DADS-2020					F			
DADS-2060			F					
DADS-2160			F					
DADS-2170	P		F					

SDPS Segment Requirement-to-Release Mapping:

Requirement ID	R1	R1.1	R2	R2.1	R3	R4	R5	R6
DADS-2180			F					
DADS-2190			F					
DADS-2200					F			
DADS-2230			F					
DADS-2270					F			
DADS-2276					F			
DADS-2300					F			
DADS-2307			F					
DADS-2315					F			
DADS-2320	P		F					
DADS-2330			P		F			
DADS-2340			P		F			
DADS-2345			F					
DADS-2350					F			
DADS-2360					F			
DADS-2370			P		F			
DADS-2380			F					
DADS-2390					F			
DADS-2410	F							
DADS-2430	F							
DADS-2440					F			
DADS-2450			P		P	F		
DADS-2460					F			
DADS-2470			P		F			
DADS-2480	P		F					
DADS-2490	P		P		P	F		
DADS-2510	P		P		P	F		
DADS-2580	P				F			
DADS-2675					F			
DADS-2770					F			
DADS-2778					F			
DADS-2900					F			
DADS-2910	P		P		P	F		
DADS-3000					F			
DADS-3010					F			
DADS-3090					F			
DADS-3100					F			
DADS-3110					F			
DADS-3115					F			
DADS-3120					F			
DADS-3125					F			
DADS-3130					F			
DADS-3135					F			
IMS-0005	P		P		F			
IMS-0010			F					
IMS-0020			F					
IMS-0030	P		P		F			
IMS-0040	F							
IMS-0050	P		F					
IMS-0060	P		F					

SDPS Segment Requirement-to-Release Mapping:

Requirement ID	R1	R1.1	R2	R2.1	R3	R4	R5	R6
IMS-0070			F					
IMS-0080	P		F					
IMS-0085			F					
IMS-0090	P		F					
IMS-0100	P				F			
IMS-0110					F			
IMS-0120	F							
IMS-0130			F					
IMS-0140	F							
IMS-0150	P		F					
IMS-0160	P		F					
IMS-0170	F							
IMS-0180	P		P		F			
IMS-0190	P		P		F			
IMS-0210			F					
IMS-0220			F					
IMS-0230	P		F					
IMS-0240	P		F					
IMS-0250			P		F			
IMS-0260	P		F					
IMS-0270	P		P		F			
IMS-0280					F			
IMS-0290	F							
IMS-0300	F							
IMS-0320	P		P		F			
IMS-0330			F					
IMS-0340			P		F			
IMS-0350	P		P		F			
IMS-0355			F					
IMS-0356	P		P		F			
IMS-0360	P		P		F			
IMS-0380			P		F			
IMS-0390			P		F			
IMS-0410	P		F					
IMS-0420	P		P		F			
IMS-0430	F							
IMS-0440					F			
IMS-0450	P		P		F			
IMS-0455			F					
IMS-0460			P		F			
IMS-0480	P		P		F			
IMS-0490	P		P		F			
IMS-0500	P		P		F			
IMS-0530	F							
IMS-0540			F					
IMS-0550	P		F					
IMS-0560	F							
IMS-0570	P		F					
IMS-0580	P		F					
IMS-0600	F							

SDPS Segment Requirement-to-Release Mapping:

Requirement ID	R1	R1.1	R2	R2.1	R3	R4	R5	R6
IMS-0610	F							
IMS-0620			P		F			
IMS-0625	F							
IMS-0630	P		F					
IMS-0640	P		F					
IMS-0650	F							
IMS-0660	P		F					
IMS-0665	P		P		F			
IMS-0670			F					
IMS-0680	P		P		F			
IMS-0690	P		P		F			
IMS-0700			P		F			
IMS-0720			P		F			
IMS-0730			P		F			
IMS-0740			P		F			
IMS-0750			P		F			
IMS-0760	P		P		F			
IMS-0770	P		F					
IMS-0780			P		F			
IMS-0790	P		F					
IMS-0800	P		P		F			
IMS-0810	P		P		F			
IMS-0820	F							
IMS-0830			P		F			
IMS-0840	F							
IMS-0860			P		F			
IMS-0870			P		F			
IMS-0880			P		F			
IMS-0890			P		F			
IMS-0900			P		F			
IMS-0910			P		F			
IMS-0915	F							
IMS-0920			P		F			
IMS-0930			P		F			
IMS-0940			P		F			
IMS-0950			P		F			
IMS-0960			P		F			
IMS-0970			P		F			
IMS-0980			P		F			
IMS-0990			P		F			
IMS-1000			P		F			
IMS-1010			P		F			
IMS-1020			P		F			
IMS-1030			P		F			
IMS-1040			P		F			
IMS-1050			P		F			
IMS-1060			P		F			
IMS-1070			P		F			
IMS-1080					F			
IMS-1090					F			

SDPS Segment Requirement-to-Release Mapping:

Requirement ID	R1	R1.1	R2	R2.1	R3	R4	R5	R6
IMS-1100					F			
IMS-1110			P		F			
IMS-1120			P		F			
IMS-1130			P		F			
IMS-1140			P		F			
IMS-1150			P		F			
IMS-1160			P		F			
IMS-1170			P		F			
IMS-1180			P		F			
IMS-1190			P		F			
IMS-1200					F			
IMS-1210					F			
IMS-1220					F			
IMS-1230					F			
IMS-1240					F			
IMS-1250					F			
IMS-1260					F			
IMS-1270			P		F			
IMS-1280			P		F			
IMS-1290			P		F			
IMS-1300	P		P		F			
IMS-1310			P		F			
IMS-1320			P		F			
IMS-1330			P		F			
IMS-1340	P		P		F			
IMS-1350			P		F			
IMS-1360			P		F			
IMS-1370			P		F			
IMS-1380	P		P		F			
IMS-1385					F			
IMS-1400			F					
IMS-1410			F					
IMS-1420			F					
IMS-1430			F					
IMS-1440			F					
IMS-1450			F					
IMS-1460			F					
IMS-1470			F					
IMS-1480			F					
IMS-1490	P		F					
IMS-1500	P		F					
IMS-1505			P		F			
IMS-1510			P		F			
IMS-1520			P		F			
IMS-1530			P		F			
IMS-1540			P		F			
IMS-1550	F							
IMS-1570			P		F			
IMS-1590			P		F			
IMS-1600	P		P		F			

SDPS Segment Requirement-to-Release Mapping:

Requirement ID	R1	R1.1	R2	R2.1	R3	R4	R5	R6
IMS-1625	P		P		F			
IMS-1630	P		P		F			
IMS-1640	P		P		F			
IMS-1645	P		P		F			
IMS-1646	P		P		F			
IMS-1650	P		P		F			
IMS-1660	P		P		F			
IMS-1665	P		P		F			
IMS-1680	P		P		F			
IMS-1690	P		P		F			
IMS-1700	P		P		F			
IMS-1710			P		F			
IMS-1720	P		P		F			
IMS-1730	P		P		F			
IMS-1740			P		F			
IMS-1760	P		P		F			
IMS-1780	P		P		F			
IMS-1785	P		P		F			
IMS-1790	P		P		F			
IMS-1800						F		

CSMS Segment Requirement-to-Release Mapping:

Requirement ID	R1	R1.1	R2	R2.1	R3	R4	R5	R6
SMC-0005	P		P		P	F		
SMC-0300	P		P		P	F		
SMC-0310	P		P		P	F		
SMC-0320			P		P	F		
SMC-0330	P		P		P	F		
SMC-0340	P		P		P	F		
SMC-0350	P		P		P	F		
SMC-1000	P		P		P	F		
SMC-1300			P		P	F		
SMC-1305					P	F		
SMC-1310					P	F		
SMC-1315					P	F		
SMC-1320					P	F		
SMC-1330					P	F		
SMC-1335					P	F		
SMC-1340					P	F		
SMC-1345					P	F		
SMC-1350					P	F		
SMC-1360					P	F		
SMC-1500					P	F		
SMC-1600					P	F		
SMC-1610					P	F		
SMC-1620					P	F		
SMC-1630					P	F		
SMC-2100	P		F					
SMC-2105	P		F					
SMC-2110	P		F					
SMC-2115			F					
SMC-2120			P		F			
SMC-2130			P		F			
SMC-2200			F					
SMC-2205			F					
SMC-2210			F					
SMC-2215			F					
SMC-2220			F					
SMC-2300	F							
SMC-2305	F							
SMC-2310	F							
SMC-2315	F							
SMC-2320	F							
SMC-2325	F							
SMC-2330	F							
SMC-2335	F							

CSMS Segment Requirement-to-Release Mapping:

Requirement ID	R1	R1.1	R2	R2.1	R3	R4	R5	R6
SMC-2400			P		F			
SMC-2405			P		F			
SMC-2410			P		F			
SMC-2415			P		F			
SMC-2420			P		F			
SMC-2430			P		F			
SMC-2450			P		F			
SMC-2500			F					
SMC-2505			F					
SMC-2510			P		F			
SMC-2515			P		F			
SMC-2520			P		F			
SMC-2530			P		F			
SMC-2535			P		F			
SMC-2540			P		F			
SMC-2600			P		P	F		
SMC-2605			P		P	F		
SMC-2610	F							
SMC-2620	F							
SMC-3300	P		P		F			
SMC-3305	P		P		F			
SMC-3310			P		F			
SMC-3315			P		F			
SMC-3320	P		P		F			
SMC-3325	P		P		F			
SMC-3330			P		F			
SMC-3335			P		F			
SMC-3340			P		F			
SMC-3345			P		F			
SMC-3350	P		F					
SMC-3355	P		F					
SMC-3370	P		F					
SMC-3375	P		F					
SMC-3380			P		F			
SMC-3385			P		F			
SMC-3390					P	F		
SMC-3395					P	F		
SMC-3397			P		F			
SMC-3400			P		F			
SMC-3410			P		F			
SMC-3415			P		F			
SMC-3420	P		P		F			
SMC-3421			P		F			
SMC-4300			P		P	F		

CSMS Segment Requirement-to-Release Mapping:

Requirement ID	R1	R1.1	R2	R2.1	R3	R4	R5	R6
SMC-4305			P		P	F		
SMC-4310	P				F			
SMC-4311	P		P		F			
SMC-4315	P		P		F			
SMC-4320	P		P		F			
SMC-4325	P		P		F			
SMC-4330			P		F			
SMC-4335			P		F			
SMC-5300			P		P	F		
SMC-5305			P		P	F		
SMC-5320	F							
SMC-5325	F							
SMC-5330	P		P		F			
SMC-5340			P		F			
SMC-5345			P		F			
SMC-5350	P				F			
SMC-5355	P				F			
SMC-5360			P		F			
SMC-6300					P	F		
SMC-6301					P	F		
SMC-6310	P		P		F			
SMC-6315	P		P		F			
SMC-6320	P		P		F			
SMC-6325	P		P		F			
SMC-6330			P		F			
SMC-6335			P		F			
SMC-6340	P		P		F			
SMC-6345	P		P		F			
SMC-6360					P	F		
SMC-6370					P	F		
SMC-6380					P	F		
SMC-6385					P	F		
SMC-6390					P	F		
SMC-6400					P	F		
SMC-6410					P	F		
SMC-6420					P	F		
SMC-7300	P		P		P	F		
SMC-7310	P		P		P	F		
SMC-7320	P		P		P	F		
SMC-8300	P		P		P	F		
SMC-8305	P		P		P	F		
SMC-8400			P		P	F		
SMC-8405			P		P	F		
SMC-8700	P		P		P	F		

CSMS Segment Requirement-to-Release Mapping:

Requirement ID	R1	R1.1	R2	R2.1	R3	R4	R5	R6
SMC-8705	P		P		P	F		
SMC-8710	P		P		P	F		
SMC-8730			P		P	F		
SMC-8750			P		P	F		
SMC-8770	P		P		P	F		
SMC-8790	P		P		P	F		
SMC-8800	P		P		P	F		
SMC-8820			P		P	F		
SMC-8840	P		P		P	F		
SMC-8841	P		P		P	F		
SMC-8860	P		P		P	F		
SMC-8880	P		P		P	F		
SMC-8890	P		P		P	F		
SMC-8920			P		P	F		
ESN-0002	P		P		P	F		
ESN-0005			P		F			
ESN-0006	P		P		P	F		
ESN-0007	F							
ESN-0010	P		P		F			
ESN-0070	P		P		P	F		
ESN-0080			P		F			
ESN-0180			P		F			
ESN-0210			P		F			
ESN-0240	P		P		P	F		
ESN-0250	P		P		F			
ESN-0280	P		F					
ESN-0290	F							
ESN-0300			F					
ESN-0340	P				F			
ESN-0350	F							
ESN-0370	P				F			
ESN-0450	P				F			
ESN-0490	P		F					
ESN-0510	P		P		F			
ESN-0590	F							
ESN-0600	F							
ESN-0610	P		F					
ESN-0620	P		F					
ESN-0640	P		.P		F			
ESN-0650	P		P		F			
ESN-0690	F							
ESN-0700					F			

CSMS Segment Requirement-to-Release Mapping:

Requirement ID	R1	R1.1	R2	R2.1	R3	R4	R5	R6
ESN-0740	F							
ESN-0750			P		F			
ESN-0760	P		P		P	F		
ESN-0770	P		P		P	F		
ESN-0775			P		P	F		
ESN-0780			P		F			
ESN-0790	P		F					
ESN-0800	P		F					
ESN-0810	P		F					
ESN-0815	F							
ESN-0830	P		F					
ESN-0840	F							
ESN-0900	P				F			
ESN-0910	P		F					
ESN-0920	P		F					
ESN-1000			P		F			
ESN-1010	P				F			
ESN-1030			F					
ESN-1060			P		F			
ESN-1065			P		F			
ESN-1070	F							
ESN-1070	P		F					
ESN-1090					P	F		
ESN-1140	P				F			
ESN-1170					F			
ESN-1180	P		P		P	F		
ESN-1181	F							
ESN-1206	P		P		P	F		
ESN-1207	P		P		P	F		
ESN-1330					F			
ESN-1350	F							
ESN-1360	F							
ESN-1361	P		P		F			
ESN-1365			P		F			
ESN-1367			P		F			
ESN-1380			P		F			
ESN-1400	P		F					
ESN-1430	F							